Belgian Radiotherapy/Oncology Awareness and Visibility Organisation

BRAVO Symposium

The increasing importance of Radiotherapy in cancer treatment

26/04/2013
BRAVO

Belgian Radiation Oncology Awareness and Visibility Organization

Steven Cuypers. Co-president Industry
Cancer is worldwide the second cause of death among human beings
Radiation Oncology is an effective treatment method to fight cancer.

It costs 1/5 of chemotherapy and does not cost more than a surgical intervention.
Belgium ranks second in Europe when it comes to filling in the estimated need for Radiation Oncology capacity as a method of treating cancer. We fill in 85% of that need. Sweden does that with 95%.
Our country has a highly specialized medical staff that uses State of the Art technology providing an excellent clinical outcome for patients and a cost efficiency for the healthcare system
Still, the medical discipline of radiation oncology lacks recognition that will lead to offering the right treatment to all cancer patients.
Important radiotherapy breakthroughs in the last decades

Dr Olivier De Hertogh
President – Belgian Association of Radiation Oncology (ABRO/BVRO)
President – Professional Union of Radiation Oncology (GBS/VBS)
A brief history of time…

1700 BC

Edwin Smith manuscript:
neurological anatomy and pathology

700 BC

Cnidus (Ancient Greece):
first school of medicine

JC

James Cook’s Mellificum Chirurgiae

1645

1895

today
1896 Emil Grubbe: first breast cancer treatment

1899 Thor Stenbeck: first cure (skin cancer)

1937 First MV linear accelerator (St Bartholomew, UK)
Radiation was an uncharted land for research

(Marie Curie’s 1903 physics & 1911 chemistry Nobel Prizes)

good for you…

Then…
The perception of risk... and benefit.

Whereas in real life, radiotherapy is at the safest end...

What has been done to get there?
What has been done…?

It’s a matter of…

And these are things we do work on…

Safety

Precision

Accuracy

Competence
What has been done...?

Safety
Technical evolution…

Safety

Also in radiation oncology…
Today, linear accelerators are safe:

- no nuclear elements
- no radioactivity
- no risk of contamination
What has been done...?

Precision
How to shape the dose?

Brachytherapy, treating from within...

Precision
How to shape the dose?

External Beam RadioTherapy (EBRT): Few patients are cubic... and their cure rate is at stake.

Vora et al., IJROBP 2007
How to shape the dose?

IMRT is « Dose painting »

- X-ray film exposed using IMRT radiation therapy
- Demonstrates the precision with which radiation dose can be delivered

Precision
How to shape the dose?

Precision
Stereotactic treatments

- optimal dose conformity
- high dose per fraction
- ablative effect on the tumor
- sparing of the organ
Stereotactic treatments

- optimal dose conformity
- high dose per fraction
- ablative effect on the tumor
- sparing of the organ

Grills et al., JCO 2010
What has been done...?

Accuracy
Imaging in radiotherapy...

For diagnostics / target definition:

- CT
- PET
- PET/CT
- PET/MRI

Accuracy

Daisne et al., Radiology 2004
Imaging in radiotherapy...

For treatment:

![Radiographic images]

We don’t do that no more!
« Image guidance » (IGRT)

Daily verification of anatomical consistency.
Management of tumor motion

4D scanners: multiple « snapshots »
Management of tumor motion

Follow tumor motion during irradiation:

gating

Accuracy
What has been done...?

Competence
Translates technical progress...

- Advanced teaching of staff
  - homogeneous medical education
  - specific track for medical physicists
  - RTT training courses

- Open to peer review / benchmarking
  Continuous evaluation of standard of care
  - ProCaRe (rectum), ProCaB (breast)

...into benefit for the patients.
What does technical progress bring?

**BREAST CANCER**
(> 1,000,000 women worldwide each year)

**LUNG CANCER**
(> 1,100,000 men worldwide each year, leading cause of cancer death)

**RECTAL CANCER**
(colorectal is ~10% of all cancers)
What does technical progress bring?

Prostate is a good example...

Comparison of Conventional-Dose vs High-Dose Conformal Radiation Therapy in Clinically Localized Adenocarcinoma of the Prostate
A Randomized Controlled Trial

Adjuvant Radiotherapy for Pathological T3N0M0 Prostate Cancer Significantly Reduces Risk of Metastases and Improves Survival: Long-Term Followup of a Randomized Clinical Trial

Ian M. Thompson,*,† Catherine M. Tangen, Jorge Paradela, M. Scott Lucia, Gary Miller,† Dean Troyer, Edward Messing, Jeffrey Forman, Joseph Chin, Gregory Swanson, Edith Canby-Hagino and E. David Crawford

79.2 Gy
70.2 Gy

... alone

... or after surgery.
Take-home messages...

Radiotherapy is:

- an efficient treatment of cancer that needs to be better known (young, technical, ...)
- rapidly progressing, driven by patient interest (cure)
- safe (no nuclear elements)
- precise and accurate
- at the forefront of quality control and management
- in need of help, to have new technologies with proven patient benefit fully implemented in Belgium (IMRT, image-guidance, ...)

Why radiotherapy needs a better visibility and better awareness: the role of BRAVO

Dr Jean-François DAISNE, MD, PhD
Board Member
Belgian Association for Radiation Oncology (ABRO/BVRO) - Radiotherapy Professional Union (GBS/VBS)
Radiotherapy in the real world

- Radiotherapy is a major anti-cancer weapon
  - 50% of cancer patients need it in their life
- CURABILITY is attributable to radiotherapy in 50% of the cases
- Radiotherapy is a highly effective SYMPTOMATIC treatment

- Anyway...
Nouveaux accidents de radiothérapie


Une infirmière surveille l'administration de rayons sur la tumeur d'un patient atteint d'un cancer dans la salle de radiothérapie.
Radiotherapy in cartoons

MUST'VE BEEN EXPOSED TO LARGE DOSES OF RADIOACTIVE Fallout Hype...
Confidence of the public
# Trust in protective actions by authority

<table>
<thead>
<tr>
<th>Risk</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical radiographies</td>
<td>35</td>
</tr>
<tr>
<td>Radiotherapy injuries</td>
<td>29</td>
</tr>
<tr>
<td>Nuclear plants</td>
<td>24</td>
</tr>
<tr>
<td>Radioactive wastes</td>
<td>18</td>
</tr>
<tr>
<td>Tchernobyl consequences</td>
<td>11</td>
</tr>
</tbody>
</table>

Baromètre IRSN 2012
AIM #1

- Radiotherapy could have a better image in the public
- It reduces confidence of patients
- Anyway, it positively impacts the public health

AIM #2

• Belgian radiotherapy is driven by conscious multi-disciplinary teams aiming at
  – Providing the safest radiotherapy
  – With the highest quality level
  – At fare rates for the whole society

• COSTS AND RISKS ARE LOW

• QUALITY IS HIGH & CONSTANTLY IMPROVED
Experts in (radio)-oncology

• Can you name
  – An expert in medical oncology?
  – An expert in surgical oncology?
  – An expert in radiation oncology?

• Radiation Oncologists are ONCOLOGISTS dedicated to Radiation use against Cancer

• Their opinion also MATTERS
AIM #3

• TO BETTER COMMUNICATE ON ONCOLOGY MATTERS

• WITH A NETWORK OF RECOGNIZED EXPERTS IN RADIATION ONCOLOGY
The position of radiotherapy in oncology

Xavier Geets
Radiation oncologist
What is cancer?

Cancer, a frequent disease:

62000 new cancers in 2010
1 in 3 males
1 in 4 females
A disease of ageing...
...in a population expected to double at 2030
From cancer stage to treatment option

Early stage $\rightarrow$ often curable

Late stage $\rightarrow$ often incurable

Local Treatments

Systemic Treatments

years...
The cornerstones of oncology treatment

Local modalities
- SURGERY
- RADIATION ONCOLOGY

Systemic modalities
- CHEMO THERAPY
- TARGETED THERAPY
% of cure according to treatment modality

Europe Against Cancer, SBU Sweden, Royal college of Australia
Radiation oncology, a key treatment modality

- Radiation oncology combined to surgery
  - To avoid extensive, mutilating surgery
  - Without compromising the patient outcome

- Radiation oncology (+/- systemic treatment)
  - When organ preservation wants to be achieved
  - When tumors are non-resectable
  - When patients are inoperable
Radiation oncology & Surgery

1214 women with BCS and node-positive disease

- Allow conservative surgery
- Increase the cure rate
- Improve patient survival
Radiation oncology & Drugs

Early disease

- Surgery
- Chemotherapy
- Radiation oncology
- Targeted therapies

Locally advanced disease

The reference treatment in locally advanced cancer
Radiation oncology
As sole modality

→ The reference treatment in non operable patients
Take-home messages

- Early cancer diagnosis: screening & education
- Radiation oncology and surgery, the cornerstones of curative cancer treatment
- Combination of treatment modalities often improves the patient’s outcome
- Current treatments are precise
- Accurate radiation oncology technologies offer a possible alternative to surgery
Bravo
A surgeon’s view on radiotherapy

Dr. Benoît Hermans,
Urology
Education

- 6 or 7 years of General Medical Education

- 4 to 6 years of Specialisation (Int med, surg, Rxth, radiology,...)
  - Assistants or trainees or fellows
  - No cross-over between specialties
  - No central approach of fields (Oncology, Pain , Emergency, Intensive care,...)
Real life

• Belgian system
  Positive points
    - Creation (€) of Multidisciplinary Oncological Clinics (min 4 physicians from diff. Speciality)
    - Accreditation system

Negative points
  - « Pay per act » system
  - Potential political concerns in Scientific Societies
  - Impact on volume for practitioners
Urology - Radiotherapy

Competition
↓
Complementarity
↓
Collaboration
↓
Synergy
Urology - Radiotherapy

Competition
(no communication)
↓
Complementarity
(patient transfer)
↓
Collaboration
(bilateral communication)
↓
Synergy
(individualized patient’s case discussion, reevaluation)
Survival of Men With Clinically Localized Prostate Cancer Treated With Prostatectomy, Brachytherapy, or No Definitive Treatment

Impact of Age at Diagnosis

BACKGROUND. The optimal treatment for men with early stage prostate cancer remains undefined. Survival of such patients after surgery, brachytherapy, or no definitive therapy was investigated specifically to determine the impact of age at diagnosis.

METHODS. In all, 60,290 men diagnosed with organ-confined, low and moderate grade prostate cancer between 1988 and 2002 were retrospectively identified from centers participating in the National Cancer Institute’s Surveillance, Epidemiology, and End Results (SEER) Program. Prostate cancer-specific mortality (PCSM) and any-cause mortality (ACM) were determined. Outcomes for patients treated by brachytherapy, surgery, or receiving no definitive treatment were compared using the Wilcoxon test, stratified by T-stage and grade, and using multivariate analysis.

RESULTS. The median follow-up time was 46 months (range, 0–189 months). For men under age 60 at diagnosis, PCSM at 10 years was 1.3%, 0.5%, and 3.7% for surgery, brachytherapy, and no definitive therapy, respectively. For men age 60 and older the PCSM was 3.8%, 5.3%, and 8.4%, respectively. On univariate and multivariate analysis, surgery and brachytherapy resulted in statistically equivalent PCSM and ACM, and both had a significantly lower PCSM and ACM versus no definitive therapy.

CONCLUSIONS. A better survival was observed in men treated with a definitive therapy. The magnitude of the benefit on PCSM or ACM was similar for both definitive therapies irrespective of age. Cancer 2006;107:2392–400.

© 2006 American Cancer Society.
Guideline for the Management of Clinically Localized Prostate Cancer: 2007 Update

Ian Thompson (Chair),* James Brantley Thrasher (Co-Chair),† Gunnar Aus,‡ Arthur L. Burnett,§ Edith D. Canby-Hagino, Michael S. Cookson,¶ Anthony V. D’Amico, Roger R. Dmochowski,‖ David T. Eton, Jeffrey D. Forman, S. Larry Goldenberg, Javier Hernandez, Celestia S. Higano, Stephen R. Kraus,** Judd W. Moul†† and Catherine M. Tangen (Prostate Cancer Clinical Guideline Update Panel)

Treatment of the Low-Risk Patient

Option. Active surveillance, interstitial prostate brachytherapy, EBRT, and RP are appropriate monotherapy treatment options for the patient with low-risk localized prostate cancer.

[Based on review of the data and Panel consensus.]

Treatment of the Intermediate-Risk Patient

Option. Active surveillance, interstitial prostate brachytherapy, EBRT, and RP are appropriate treatment options for the patient with intermediate-risk localized prostate cancer.

[Based on review of the data and Panel consensus.]
Why synergy?
Fig. 3. Rate of complications reported with interstitial prostate brachytherapy.*

Fig. 4. Rate of complications reported with external beam radiotherapy.*
FIG. 3. Rate of complications reported with interstitial prostate brachytherapy.*

FIG. 5. Rate of complications reported with radical prostatectomy.*
Comparative Effectiveness

Prostate Cancer Results
Study Group
2009

Peter Grimm, DO
Seattle Prostate Institute

Latest update 3/31/09
Prostate Cancer Results
Study Group

• **Problem:** In the absence of randomized studies, patients, physicians, carriers, Medicare, etc: need a means to compare the effectiveness of modern treatments

• **Purpose:** The PCRSG will compare and share results for prostate cancer that are utilizable for all those who are interested
Expert Panel

- David Bostwick, MD  Bostwick Laboratories
- David Crawford, MD  Univ Colorado
- Peter Grimm, DO Seattle
- Mira Keyes, MD BC Cancer Agency
- Kupelian, Patrick, MD  MD Anderson Orlando
- Robert Lee  Duke University Medical Center
- Brian Moran, MD Chicago Prostate Institute
- Greg Merrick, MD Schiffler Cancer Center
- Jeremy Millar, MD  Australia
- Mack Roach, MD  UCSF
- Richard Stock, MD  Mt. Sinai  New York
Expert Panel

- Katsuto Shinohara, MD  UCSF
- John Sylvester, MD SPI
- Mark Scholz, MD  Prostate Cancer Research Institute
- Ed Weber, MD  SPI
- Anthony Zietman, MD  Harvard Joint Center
- Michael Zelefsky, MD  Memorial Sloan Kettering
- Fellows  Jason Wong, MD
- Residents:
  - Jyoti Mayadev, MD  University of Washington
  - Stacy Wentworth, MD  Wake forest
  - Robyn Vera, DO  Medical College of Virginia

5/7/2013
Study

• >15,000 articles reviewed from 2000-2009
• Pub Med, Medline, Google Scholar, Elsevier search
• 603 Treatment Results Articles Identified
• Expert Panel Established Criteria for Inclusion
• Treatment Articles screened for study group criteria
Low Risk

> 40 mo Med F/U or < 100 pts

- Prostate Cancer Results Study Group 3/31/09
- Numbers within symbols refer to references
Conclusion

Radiation therapists and urologists have proven their skills and expertises

The Challenge for the future is to combine the forces for a SYNERGY

– Patient oriented
– Commercially neutral (No marketing pressure)
– Financially independant (Hospital’s management)
– Non biased approach (Professional Societies)
NEW TECHNOLOGIES ISSUE: NOT ONLY a PROBLEM in BELGIUM...

Alberto Bossi
Institut Gustave Roussy, Villejuif, France
...new technologies for RT...in France !?

...how to evaluate them ?
FIGURE 1 : RÉPARTITION DES CENTRES DE RADIOTHÉRAPIE PAR STATUT

TABLEAU 1 : RÉPARTITION DU NOMBRE DE CENTRES DE RADIOTHÉRAPIE PAR STATUT EN 2011

<table>
<thead>
<tr>
<th>Statut</th>
<th>Nombre de centres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privé</td>
<td>91</td>
</tr>
<tr>
<td>Cabinet libéral</td>
<td>87</td>
</tr>
<tr>
<td>Établissement de santé privé</td>
<td>4</td>
</tr>
<tr>
<td>Public</td>
<td>81</td>
</tr>
<tr>
<td>CHU-CHR</td>
<td>22</td>
</tr>
<tr>
<td>CH</td>
<td>32</td>
</tr>
<tr>
<td>ESPIC CLCC</td>
<td>20</td>
</tr>
<tr>
<td>ESPIC (hors CLCC)</td>
<td>6</td>
</tr>
<tr>
<td>HIA</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>172</strong></td>
</tr>
</tbody>
</table>

Source : Observatoire de la radiothérapie 2010
### Tableau 2 : Nombre de centres de radiothérapie par pays en Europe

<table>
<thead>
<tr>
<th>Pays</th>
<th>Nombre de centres de radiothérapie</th>
<th>Rapport Nombre de centres RTH/1 000 000 habs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allemagne</td>
<td>289</td>
<td>3,5</td>
</tr>
<tr>
<td>France</td>
<td>172</td>
<td>2,7</td>
</tr>
<tr>
<td>Italie</td>
<td>170</td>
<td>2,8</td>
</tr>
<tr>
<td>Espagne</td>
<td>115</td>
<td>2,5</td>
</tr>
<tr>
<td>Royaume-Uni</td>
<td>68</td>
<td>1,1</td>
</tr>
<tr>
<td>Suisse</td>
<td>36</td>
<td>4,6</td>
</tr>
<tr>
<td>Belgique</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pays-Bas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norvège</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source : AIEA, traitement INCa

### Tableau 4 : Nombre d'appareils de traitement par pays en Europe

<table>
<thead>
<tr>
<th>Pays</th>
<th>Nombre d'appareils de traitements</th>
<th>Rapport Nombre d'appareils de traitements/1 000 000 habs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allemagne</td>
<td>529</td>
<td>6,5</td>
</tr>
<tr>
<td>France</td>
<td>426</td>
<td>6,7</td>
</tr>
<tr>
<td>Italie</td>
<td>384</td>
<td>6,3</td>
</tr>
<tr>
<td>Royaume-Uni</td>
<td>314</td>
<td>6,8</td>
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<tr>
<td>Espagne</td>
<td>230</td>
<td>3,7</td>
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<tr>
<td>Pays-Bas</td>
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<td>6,7</td>
</tr>
<tr>
<td>Belgique</td>
<td>92</td>
<td>8,5</td>
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<tr>
<td>Suisse</td>
<td>53</td>
<td>6,8</td>
</tr>
<tr>
<td>Norvège</td>
<td>38</td>
<td>7,8</td>
</tr>
</tbody>
</table>

Source : AIEA, traitement INCa
FIGURE 4. RÉPARTITION DES APPAREILS DE TRAITEMENT PAR ANCIENNETÉ EN 2010 (158 CENTRES)

INCa, Observatoire de la Radiothérapie, 2011
<table>
<thead>
<tr>
<th></th>
<th>Polyvalents</th>
<th>Accélérateurs</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Dédiés à la stéréotaxie</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CABINET LIBÉRAL</td>
<td>182</td>
<td></td>
<td>182</td>
<td>43 %</td>
</tr>
<tr>
<td>ÉTABLISSEMENT PRIVÉ</td>
<td>8</td>
<td></td>
<td>8</td>
<td>2 %</td>
</tr>
<tr>
<td>CH</td>
<td>60</td>
<td>1</td>
<td>62</td>
<td>15 %</td>
</tr>
<tr>
<td>CHU-R</td>
<td>57</td>
<td></td>
<td>57</td>
<td>13 %</td>
</tr>
<tr>
<td>ESPIC (hors CLCC)</td>
<td>20</td>
<td></td>
<td>20</td>
<td>5 %</td>
</tr>
<tr>
<td>ESPIC CLCC</td>
<td>80</td>
<td>5</td>
<td>95</td>
<td>22 %</td>
</tr>
<tr>
<td>HIA</td>
<td>2</td>
<td></td>
<td>2</td>
<td>&lt;1 %</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>409</strong></td>
<td><strong>6</strong></td>
<td><strong>426</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source : Observatoire de la radiothérapie 2011, traitement INCa
### TABLEAU 3 : RÉPARTITION DU PARC D’APPAREILS DE TRAITEMENT PAR STATUT DÉBUT 2011

<table>
<thead>
<tr>
<th></th>
<th>Accélérateurs</th>
<th></th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Polyvalents</td>
<td>Dédiés à la stéréotaxie</td>
<td></td>
<td></td>
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<td>182</td>
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<tr>
<td>ÉTABLISSEMENT PRIVÉ</td>
<td>8</td>
<td></td>
<td>8</td>
<td>2  %</td>
</tr>
<tr>
<td>CH</td>
<td>60</td>
<td>1</td>
<td>62</td>
<td>15 %</td>
</tr>
<tr>
<td>CHU-R</td>
<td>57</td>
<td>1</td>
<td>57</td>
<td>13 %</td>
</tr>
<tr>
<td>ESPIC (hors CLCC)</td>
<td>20</td>
<td></td>
<td>20</td>
<td>5  %</td>
</tr>
<tr>
<td>ESPIC CLCC</td>
<td>80</td>
<td>5</td>
<td>95</td>
<td>22 %</td>
</tr>
<tr>
<td>HIA</td>
<td>2</td>
<td></td>
<td>2</td>
<td>&lt;1 %</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>409</strong></td>
<td><strong>6</strong></td>
<td><strong>426</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source : Observatoire de la radiothérapie 2011, traitement INCa

INCa, Observatoire de la Radiothérapie, 2011
"low-tech" material in >50 % of the Centers

...but even in CLCC the situation is not that better
LIVRE BLANC DE LA RADIOThERAPIE EN FRANCE

DOUZE OBJECTIFS

POUR AMELIORER

UN DES TRAITEMENTS MAJEURS DU CANCER

2013
FIGURE 11 : DISPONIBILITÉ DE LA RADIOTHÉRAPIE AVEC MODULATION D'INTENSITÉ

Pourcentage de régions où la technique est disponible

Source : Observatoire de la radiothérapie 2008-2011, traitement INCa

SFRO, Livre Blanc de la Radiothérapie, 2013
FIGURE 24. ÉVOLUTION DU NOMBRE DE CENTRES AYANT ACCÈS AUX MODALITÉS COMPLÉMENTAIRES DE SIMULATION (135 CENTRES)

SFRO, Livre Blanc de la Radiothérapie, 2013
...only 1/3 of centers have adopted IMRT / IGRT for their treatment...
<table>
<thead>
<tr>
<th>Radiation Therapy Type</th>
<th>Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palliative irradiation</td>
<td>436.37</td>
</tr>
<tr>
<td>3D- Conformal irradiation</td>
<td>996.58</td>
</tr>
<tr>
<td>IMRT</td>
<td>1094.07</td>
</tr>
<tr>
<td>Stereotactic Body irradiiation, SBRT</td>
<td>2219.01</td>
</tr>
<tr>
<td>Treatment</td>
<td>Euro / fraction</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>3D-Conformal irradiation</td>
<td>136.61</td>
</tr>
<tr>
<td>IMRT</td>
<td>180.89</td>
</tr>
<tr>
<td>Tomotherapy</td>
<td>445.62</td>
</tr>
<tr>
<td>Stereotactic Body irradiation, SBRT</td>
<td>1379.50 (774.47)</td>
</tr>
</tbody>
</table>
Our study involves randomized comparison of intensity modulated radiation therapy (IMRT) with standard technique for adjuvant breast radiotherapy in breast cancer.

### Plenary 1

**Phase III Randomized Study of Intensity Modulated Radiation Therapy Versus Standard Wedging Technique for Adjuvant Breast Radiotherapy**

J. Pignol\(^1\), I. Olivotto\(^2\), E. Rakovitch\(^1\), S. Gardner\(^1\), I. Ackerman\(^1\), K. Sixel\(^1\), W. Beckham\(^2\), T. Vu\(^1\), E. Chow\(^1\), L. Paszat\(^1\)

\(^1\)Sunnybrook Health Sciences Centre, Toronto, ON, Canada, \(^2\)Vancouver Island Cancer Centre, Victoria, BC, Canada

354 breast cancer pts randomized: **OLD vs. NEW technologies.**

End-points: severe skin toxicities

**Conclusions:** Compared to the standard WC radiation treatment, BIMRT significantly reduces the development of severe moist desquamation, and is therefore recommended for adjuvant radiotherapy of breast cancer.

**Table 1: Multivariate analysis of BIMRT versus WC**

<table>
<thead>
<tr>
<th>Endpoints</th>
<th>NCIC-CTG Grade 3-4</th>
<th>Desquamation Grade 2-4</th>
<th>IMF Desquamation Grade 2-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technique (BIMRT vs WC)</td>
<td>(p=0.0372)</td>
<td>(p&lt;0.0001)</td>
<td>(p&lt;0.0001)</td>
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<tr>
<td>Energy (6 MV versus others)</td>
<td>(p=0.0059)</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Breast volume (V_{95%})</td>
<td>(p&lt;0.0001)</td>
<td>(p&lt;0.0001)</td>
<td>(p&lt;0.0001)</td>
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<tr>
<td>Centre (Toronto vs Victoria)</td>
<td>(p&lt;0.0001)</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>DVH’s homogeneity</td>
<td>NS</td>
<td>(p=0.0007)</td>
<td>(p=0.0008)</td>
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**ASTRO 2006, abs.1**
High-dose IGRT vs non-IGRT for prostate cancer

**Late GU Grade 2+ Toxicity Free Survival**

- **IGRT**: Blue triangles
- **Non-IGRT**: Red squares

Probability vs. Number of subjects at risk:

- **Month**: 0, 12, 24, 36, 48, 60, 72, 84
- **Probability**: 1, 0.8, 0.6, 0.4, 0.2, 0

**p = 0.024**

---

**Clinical Investigation**

**Improved Clinical Outcomes with High-Dose Image Guided Radiotherapy Compared with Non-IGRT for the Treatment of Clinically Localized Prostate Cancer**

Michael J. Zelefsky, M.D.,* Marisa Kollmeier, M.D.,* Brett Cox, M.D.,*
Anthony Fidaleo, B.A.,* Dahlia Sperling, B.A.,* Xin Pei, Ph.D.,*
Brett Carver, M.D., Ph.D.,† Jonathan Coleman, M.D.,† Michael Lovelock, Ph.D.,†
and Margie Hunt, B.S.†

*Departments of Radiation Oncology, †Medical Physics, and †Surgery, Memorial Sloan-Kettering Cancer Center, New York, ...

---

**High Risk**

- **IGRT (n=35)**: Blue triangles
- **Non-IGRT (n=61)**: Red squares

Probability vs. Month:

- **Month**: 0, 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84
- **Probability**: 1, 0.8, 0.6, 0.4, 0.2, 0

**p = 0.041**

---

**Late GU Grade 2+ Toxicity Free Survival**

- **IGRT**: Blue triangles
- **Non-IGRT**: Red squares

Probability vs. Number of subjects at risk:

- **Month**: 0, 12, 24, 36, 48, 60, 72, 84
- **Probability**: 1, 0.8, 0.6, 0.4, 0.2, 0
Survie des personnes atteintes de cancer en France 1989-2007

Étude à partir des registres des cancers du réseau Francim
Gastric Ca

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Biliary tract Ca

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fevrier 2013
Lung Ca

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my conclusions...
Cost and Cost-Effectiveness of Radiotherapy.

Prof. Dr. Yolande Lievens
President of College of Physicians in Radiotherapy
health care expenditures as percentage of GDP
Health Care Budget

Cancer Care Budget
4% – 9% of health care budget

Radiotherapy Budget
5% of cancer care budget
0.5% of total health care budget
50% cancer patients require radiotherapy

Sullivan et al, Lancet Oncol 2011
radiotherapy cost

cost calculation in 10 radiation oncology departments in Belgium
average cost per treatment in each department

Hulstaert et al. KCE Rapport 198, 2013
more complex treatments

\[
\begin{align*}
\Rightarrow & \quad \text{more time} \\
\Rightarrow & \quad \text{more resources}
\end{align*}
\]

\textit{capital investments}
\textit{human resources}

\text{treatment time} > \text{preparation time}
cost of lung cancer treatment, Belgium

radiotherapy cost

adapted from Hulstaert et al. KCE Rapport 198, 2013
What is
the (level 1) evidence?
the cost?
the value for money?
the budgetary impact?
extra cost
extra effect
new treatment

cost
effect
standard treatment

cost per (quality adjusted) life year gained (QALY)  
= incremental cost–effectiveness ratio
  
= iCER
more effective
less costly

less effective
more costly

more effective
more costly

less effective
less costly

± 30,000€ per (quality adjusted) life year

iCER?
advanced radiotherapy techniques

improve outcome
   better local control, survival
   less long term toxicity
   better Quality of Life

higher upfront costs
   compensated by lower toxicity costs
   less costs of relapse
improved survival through SBRT
(stereotactic body radiotherapy, inoperable early–stage lung cancer)
stereotactic body radiotherapy (early-stage lung cancer)

3D-conformal radiotherapy

radio frequency ablation

higher effect, lower cost (NL, 2004–7)

€4,600/QALY (2009, USA)

€10,750/QALY (USA, 2009)

definitive robotic surgery

gefitinib (Iressa®) (advanced stage lung cancer)

chemotherapy €22,750 – €42,250/QALY (UK, 2010)
“It’s always too early until, unfortunately, it’s suddenly too late!”

(Buxton)
coverage with evidence development

provide payment coverage that ensures emerging technologies that show initial evidence of potential benefit to be available
gather evidence in an ongoing manner throughout the relatively short life cycle of radiation oncology technology

Hulstaert et al. KCE Rapport 198, 2013
Conclusions

- Radiotherapy budget is limited, radiotherapy costs are low.

- Innovative radiotherapy treatments (may) increase short-term costs, decrease long-term health care expenses, resulting in a long-term cost-effectiveness.

- Health economic evaluations provide the necessary evidence of value for money.

- Coverage with evidence development can support the early introduction of promising new technologies.

Thank you for your attention.