

"Role of brachytherapy in radiotherapy system in Poland. Practical prostate cancer brachytherapy."

Janusz Skowronek MD, PhD, Ass. Prof.
Brachytherapy Department, Greater Poland Cancer Centre, Poznań,
Poland



7th Conference on Clinical Oncoradiology, 14–15th March, 2012,
Blokhin Russian Cancer Research Center, Moskwa, Russia.

Trends

- **Seeds – prostate, breast, lung, HAN, others,**
 - **PDR brachytherapy,**
 - **Image-based 3D planning,**
 - **Intraoperative brachytherapy,**
- **Intensive Modulated brachytherapy,**
 - **New applicators and techniques,**
 - **Electronic brachytherapy,**
- **Quality Assurance, Quality of Life.**

Radiotherapy in Poland - 2011

Population: 37.5 millions

Radiotherapy centers include: 30 (3 privat), 3-4 built (privat)

Brachytherapy departments, laboratories: 28 (3 privat)

EBRT accelerators: 111 (min. 10-15% to exchange)

- Co-60 5 (withdrawing)

- Linear accelerators 106 (2 Mobetrans, 2 Cybknife)

- Simulators 43

(ultimately planned - 140-150 accelerators)

1/250 000 inhabitants

Radiotherapy in Poland - 2011

Brachytherapy units:

41

LDR(MDR):

1 (22 in 2002) withdrawn now

HDR:

35 (14 in 2002)

Nucletron - 34, IBt Bebig - 1

PDR:

6 (4 in 2002)

Seeds: Poznań, Warszawa, Jastrzębie Zdrój

Reimbursement – 2012?

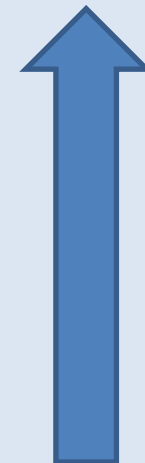
Radiotherapy in Poland - 2011

- External Beam Radiation Therapy – 63646 patients
- **Brachytherapy** – **9880 pts (15.5%)**

Total – 73526 patients

- Morbidity (estimated) – 150-160 000 (?)
- 28/30 of RT centres use BT:

- GCC Poznań	1159
- Gliwice	926
- Kielce	908
- Bydgoszcz	882
- Warszawa	637



Radiotherapy in Poland - 2011

New patients yearly

(2008):

(2011):

External Beam Radiotherapy

57826

63646



10%

Brachytherapy

9218 (15,9%)

9880 (15,5%)



7,2%

Radiotherapy in Poland - 2011

Physicians (2008):

radiotherapy specialists – 379

in training – 123

Physicians (2011):  **18%**

radiotherapy specialists – 431

brachytherapy – 50-70?

in training – 160

Greater Poland Cancer Center (GCC), Poznań

1. Largest number of patients treated with BT in Poland,

2. The largest case number of:

prostate

lung,

oesophagus,

breast,

head and neck,

skin cancers.

3. gynaecology - third place in Poland,

4. First Centre – seeds (2008), Contura (2011), SAVI (2012)

5. Interstitial Hyperthermia with BT,

6. APBI, HDR prostate monotherapy – routine,

7. Endovascular BT - history.

Greater Poland Cancer Center (GCC), Poznań

Radical brachytherapy:

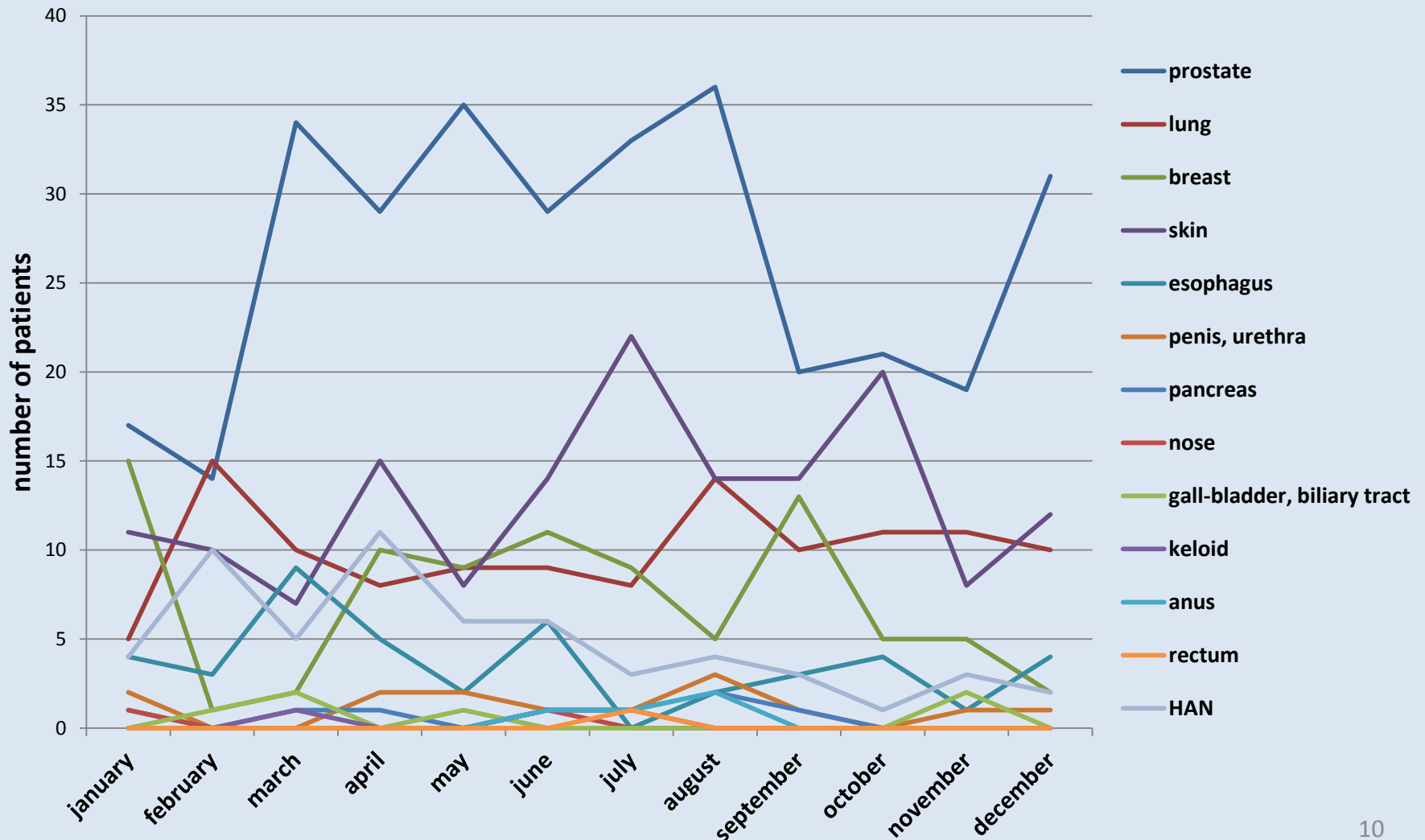
- prostate cancer
- skin cancer
- breast cancer
- gynaecological cancers
- anal cancer
- head and neck cancer ~ 50%
- *rarely:* lung cancer ~ < 5%
- oesophageal cancer ~ < 5%
- restenosis in femoro-popliteal arteries and in coronary arteries (*history*)

Palliative brachytherapy:

- pancreas, bile duct cancer
- oesophageal cancer
- lung cancer
- head and neck cancer ~ 50%
- brain tumors (*history*)

Greater Poland Cancer Center (GCC), Poznań

Diagnosis (2011)



Brachytherapy Department

- 3 shielding rooms:

**PDR,
HDR I + SWIFT,
HDR II + IBU (Simulix),**

- Operating room + SWIFT/SPOT,
- Laboratory of Treatment Planning and Brachytherapy Dosimetry
- Bronchoscopy laboratory,
- Hyperthermia laboratory,
- Out-patient Clinic,
- 2 wards (6 beds),
- Duty-room,
- Nurse's station.

Brachytherapy Department - equipment

- Microselectron HDR V3 – 2009
- Microselectron HDR classic – 2001/2008 (V3)
- **Microselectron PDR – 1999 (new in 2012)**
- Hyperthermia BSD-500 – 2006
- Phillips Endura RTG – 2006
- Simulix Evolution - 2011

- PLATO vs. 14.1.3. – 2006
- Oncentra gynaecology, Oncentra Masterplan – 2008
- SWIFT „real-planning” System - 2006
- SWIFT/SPOT Combo planning system – 2008

- Seeds - 2008

- Oncentra 4.0 - 2011



HDR



PDR



Hyperthermia

Simulix CT



Operating room



Team

- **Physicians** - 3 radiotherapy specialist
- - 4 (in training),
- - 1 pulmonologist (consultant),
- **Physicists** - 4
- **X-ray technicians** - 2
- **Treatment nurses** - 5
- **Ward nurses** - 8
- **Secretary** - 2
- **Anesthetist** - 1
- **Nurse anesthetic** - 1 - 2

Brachytherapy in Poland - 2011

Prostate cancer as example

Brachytherapy of prostate cancer

Greater Poland Cancer Centre
(2006 - 2011)

HDR brachytherapy – **1610** procedures

Permanent implants – **63** patients
(since December 2008)

Permanent implants – first centre in Poland!

Implants - nowadays:

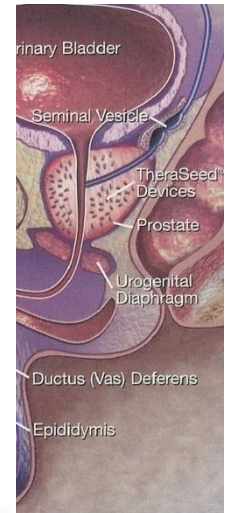
2 oncological centres (*Poznań, Warsaw*),
1 private centre (*Jastrzębie Zdrój*) – no data



Greatest problems...

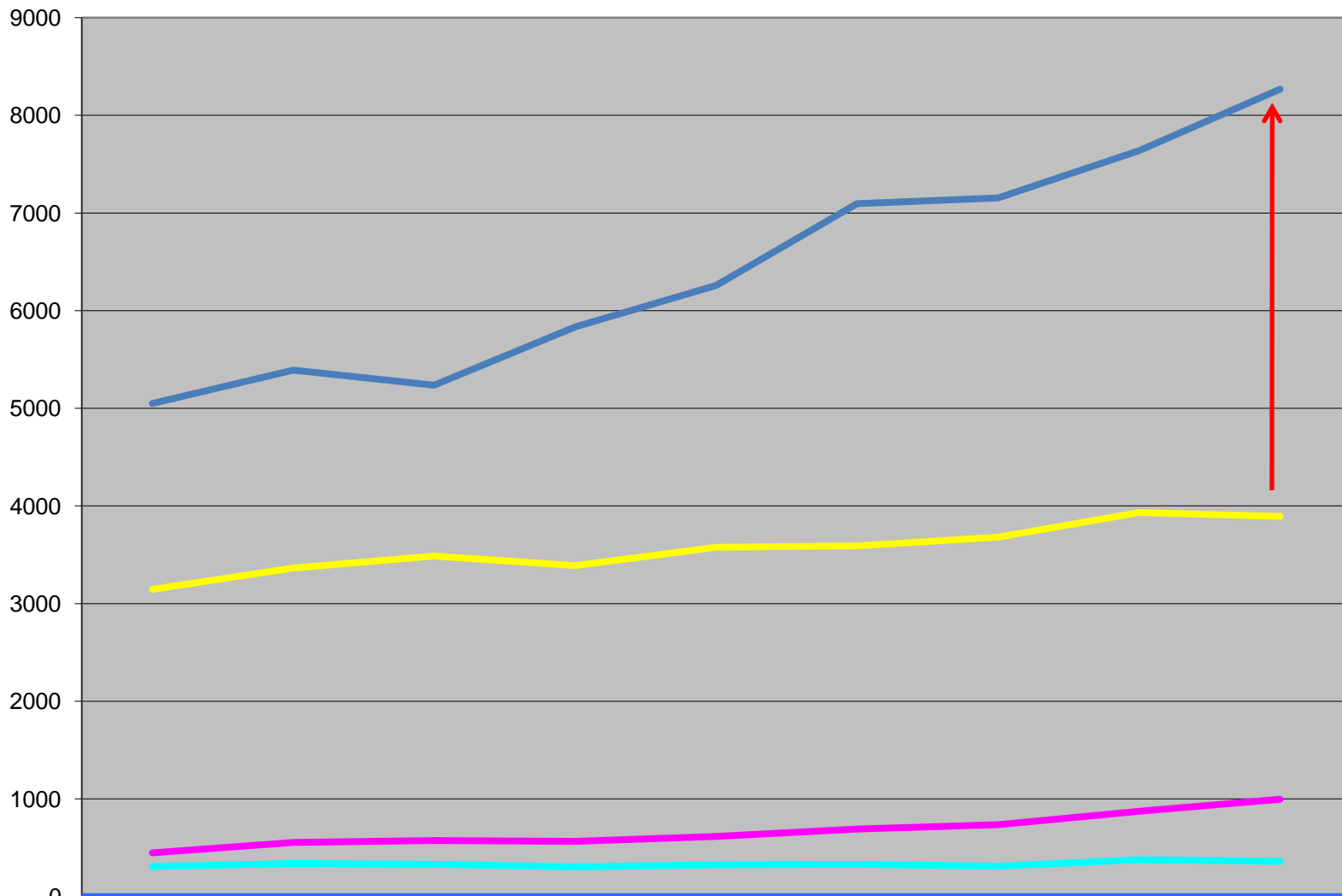
Impotence

Urinary incontinence

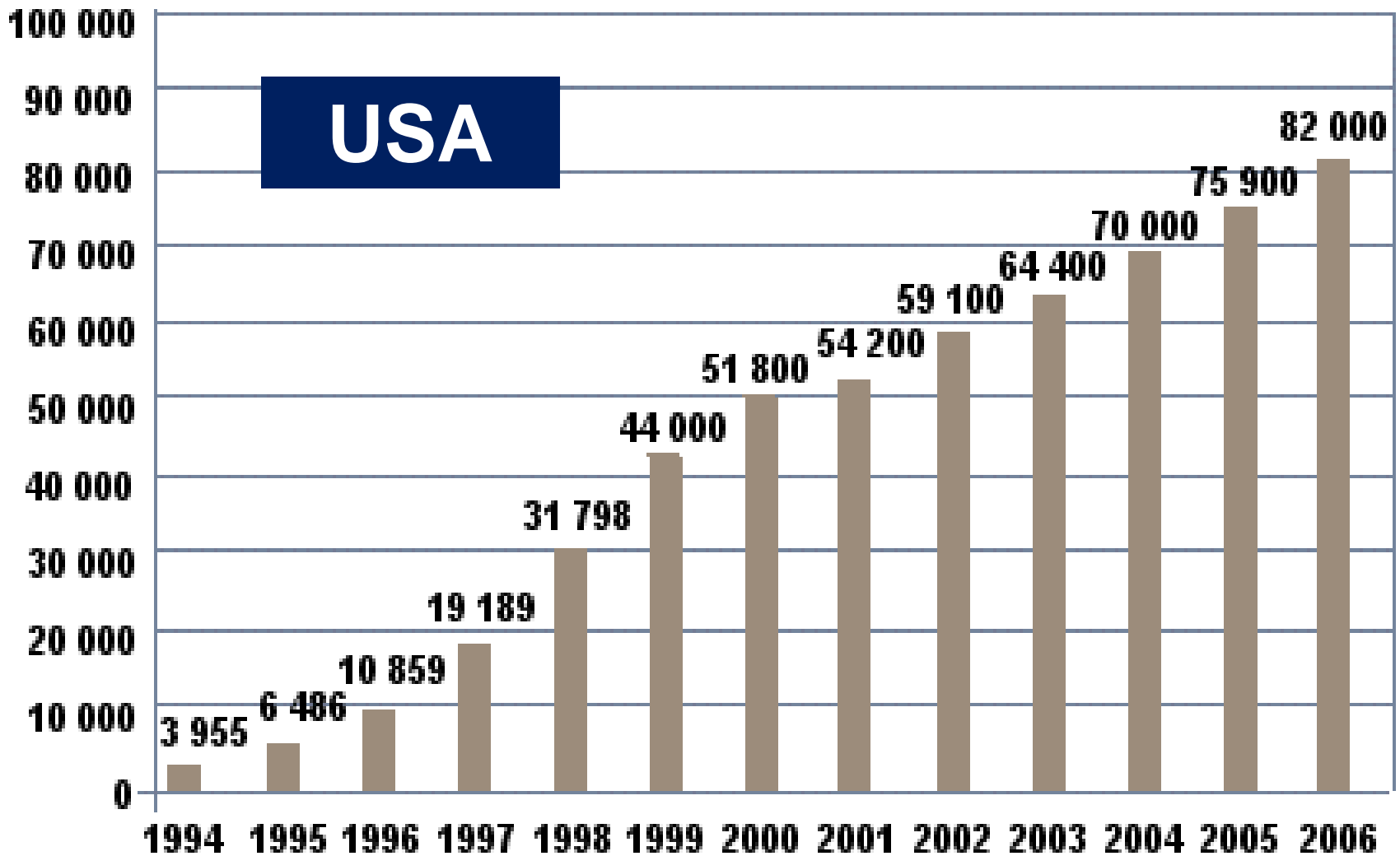


Prostate cancer - morbidity, mortality in Poland

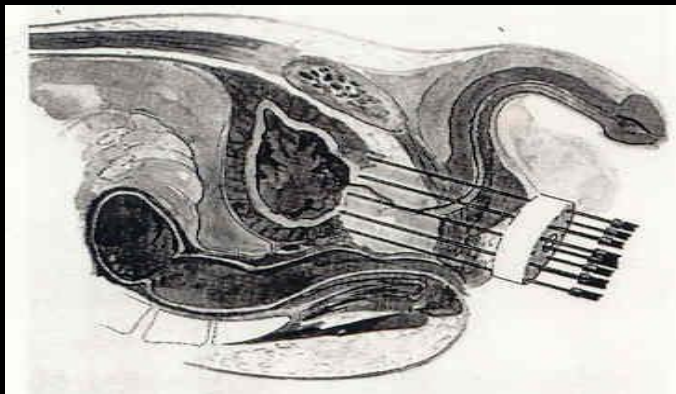
Number of patients



	2000	2001	2002	2003	2004	2005	2006	2007	2008
Morbidity - Poland	5049	5391	5236	5832	6257	7095	7154	7638	8268
Morbidity - Greater Poland	448	555	573	565	617	691	737	874	997
Mortality - Poland	3147	3365	3488	3390	3578	3592	3681	3932	3892
Mortality - Greater Poland	308	338	331	305	325	330	310	377	360



Brachytherapy cases done in the USA



Prostate cancer

	USA (2010)	Europe (2004)	Poland (2008)
Morbidity	217.730	240.000	8.268
	14,7%	35,4%	47,1%
Mortality	32.050	85.000	3.892

Japan – 15.1/100.000  Sveden – 81.8/100.000

* *Ca Cancer J Clin, 2010*

* *PCBE Reports, Guedea, RO 2010*

Patterns of care for brachytherapy in Europe: Updated results

Ferran Guedea, Jack Venselaar, Peter Hoskin, Taran Paulsen Hellebust, Didier Peiffert, Bradley Londres, Montse Ventura, Jean-Jacques Mazon, Erik Van Limbergen, Richard Pötter, Gyorgy Kovacs

Radiotherapy and Oncology 97 (2010) 514–520

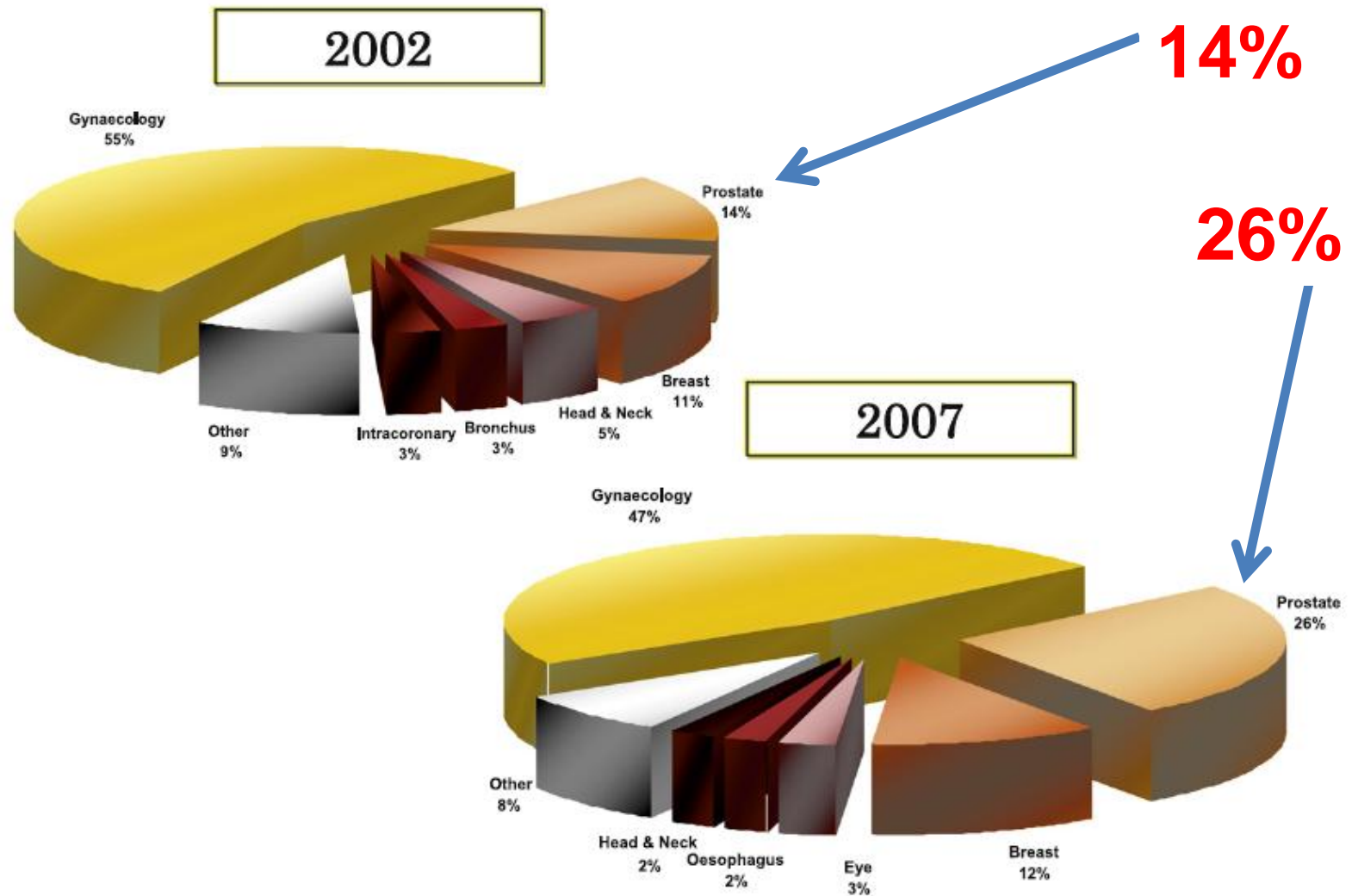


Fig. 3. Most common treatment localizations, group I (2002 vs. 2007).

Patterns of care for brachytherapy in Europe: Updated results

Ferran Guedea, Jack Venselaar, Peter Hoskin, Taran Paulsen Hellebust, Didier Peiffert, Bradley Londres, Montse Ventura, Jean-Jacques Mazon, Erik Van Limbergen, Richard Pötter, Gyorgy Kovacs
Radiotherapy and Oncology 97 (2010) 514–520

Prostate cancer 2007 (17% of BT in Europe)

- gynaecological (59%), prostate (17%), breast (9%), lung/bronchus (3%), and esophagus (2%).

In group I

- the five most common tumor sites were as follows: gynaecological (48%), prostate (26%), breast (12%), eye (3%), and esophagus (2%).

Greater Poland Cancer Centre (2009)

Gynaecological 371 (26.6%),
non-gynaecological 1024 (73.4%)

prostate 322 (23.1%)

> 20 YEARS AGO

Radical prostatectomy

or

External beam irradiation

10 - 20 YEARS AGO

Radical prostatectomy

or

Conventional external beam

or

Conformal external beam

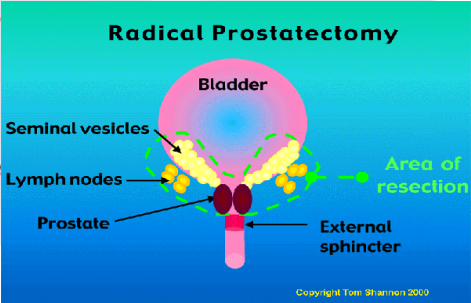
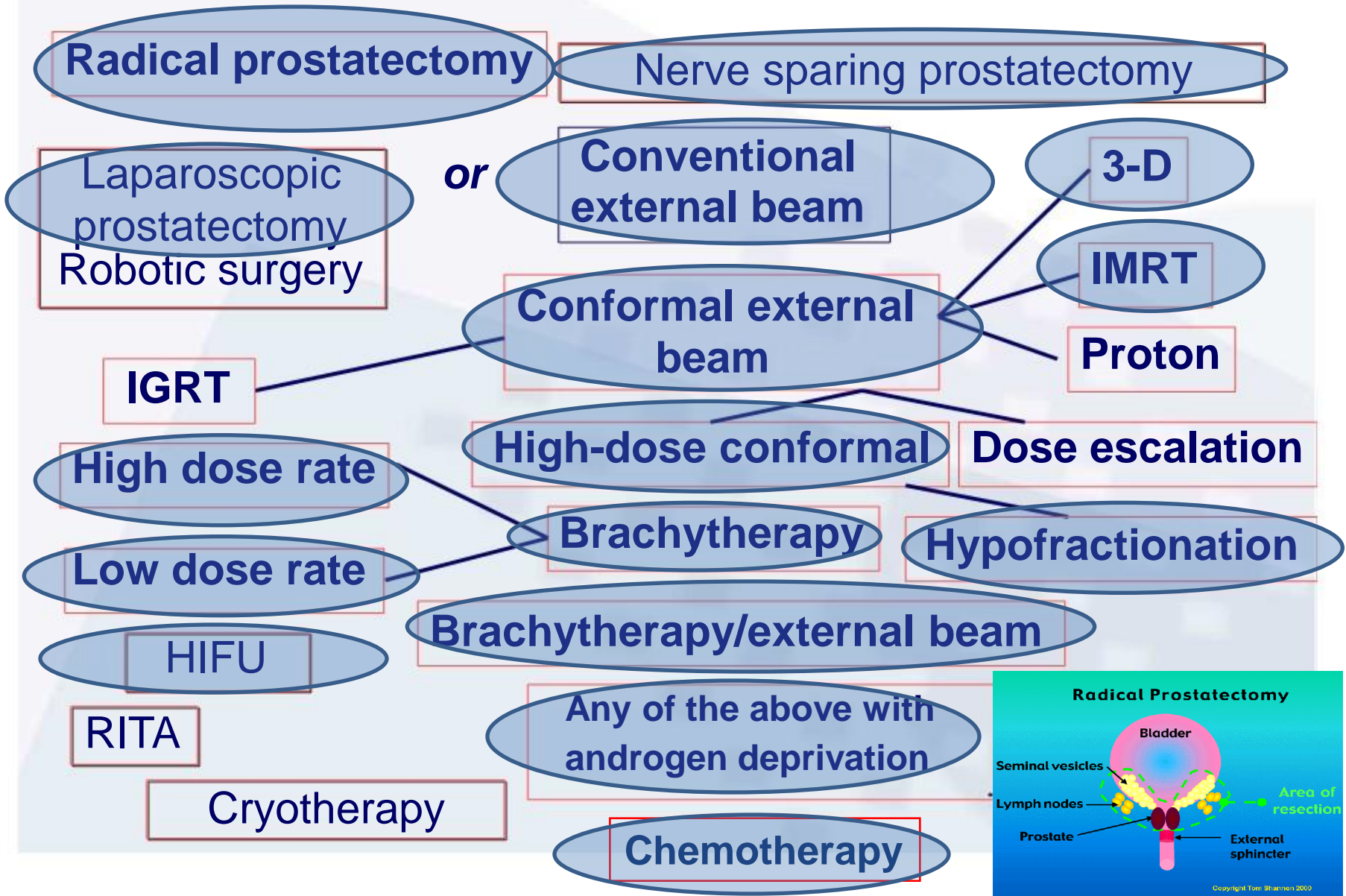
or

Brachytherapy

or

Brachytherapy/external beam

Today - Poland



ABS Prostate High-Dose Rate Task Group, ABS Prostate Low-Dose Rate Task Group

Contact Us

Members Only



American
Brachytherapy
Society

brachytherapy guidelines

[HDR Radiobiologic Dose Equivalent Worksheets #1 / Instructions](#)

[HDR Radiobiologic Dose Equivalent Worksheets #2 / Instructions](#)

[Cervical Cancer Brachytherapy Task Group](#)

[ABS Breast Brachytherapy Task Group](#)

[ABS Prostate High-Dose Rate Task Group](#)

[ABS Prostate Low-Dose Rate Task Group](#)

[About the Society ▶](#)

[About Brachytherapy ▶](#)

[Brachytherapy Guidelines ▶](#)

[Industry & ABS News ▶](#)

[Resources & Related Links ▶](#)

[Meetings & Conferences ▶](#)

[Publications ▶](#)

[Membership Information ▶](#)

[Resident Fellowship Programs ▶](#)

[ABS Corporate Sponsors ▶](#)

[Home ▶](#)



ELSEVIER

ESTRO/EAU/EORTC recommendations on permanent seed implantation for localized prostate cancer

Daniel Ash^{a,*}, Anthony Flynn^a, Jan Battermann^b, Theodoros de Reijke^c, Paulo Lavagnini^d, Leo Blank^e

^aDepartment of Clinical Oncology and Medical Physics, Cookridge Hospital, Leeds, UK

^bDepartment of Radiotherapy, Academisch Ziekenhuis, Utrecht, Germany

^cDepartment of Urology, Academisch Medisch Centrum, Amsterdam, The Netherlands

^dInstituto Tumori, Genoa, Italy

^eDepartment of Radiotherapy, Free University, Amsterdam, The Netherlands

Received 18 September 2000; accepted 27 September 2000

	Recommended Do well	Optional Fair	Investigational Do poorly
PSA (ng/ml)	< 10	10-20	>20
Gleason score	5-6	7	8-10
Stage	T1c-T2a	T2b-T2c	T3
IPSS	0-8	9-19	>20
Prostate volume (g)	<40	40-60	>60
Q _{max} ml/s	>15	15-10	<10
Residual volume cm ³			>200
TURP ±			+

Risk categories (N0 M0) – Clinically localized

	Low	Intermediate	High	Very high, locally advanced
T	1-2a	2b, 2c	3a	3b, 4
PSA	< 10	10-20	>20	Any
Gleason score	< 7	7	>7	any

Metastatic:
 any T, N1 M0
 any T, any N, M1

Very low - PSA<10 ng/ml Gleason <6 , density PSA < 0,15 ng/ml/g, below 3 wateczków z biopsji zajętych w każdym poniżej 50 % nacieku

Contraindications

ESTRO/EAU/EORTC RECOMMENDATIONS ON PERMANENT SEEDIMPLANTATION FOR LOCALISED PROSTATE CANCER

1. expected survival time < 5 years (?),
2. metastasis,
3. TURP in the past with considerable damage to the prostate (<3 months ?),
4. persistent hematuria, the regular use of aspirin or anticoagulants,
5. prostate volume > 60 cm cc (HT!).

Brachytherapy in Poland - 2011

Temporary - HDR



ELSEVIER

Radiotherapy and Oncology 74 (2005) 137–148

RADIOTHERAPY
& ONCOLOGY
JOURNAL OF THE EUROPEAN SOCIETY FOR
THERAPEUTIC RADIOLOGY AND ONCOLOGY

www.elsevier.com/locate/radonline

GEC/ESTRO-EAU recommendations on temporary brachytherapy using stepping sources for localised prostate cancer

György Kovács^{a,*}, Richard Pötter^b, Tillmann Loch^c, Josef Hammer^d,
Inger-Karine Kolkman-Deurloo^e, Jean J.M.C.H. de la Rosette^f, Hagen Bertermann^g

^a*Interdisciplinary Brachytherapy Centre, University Hospital Schleswig-Holstein Campus Kiel, Arnold Heller Str 9, D-24105 Kiel, Germany*

^b*University Clinic for Radiotherapy and Radiobiology, Vienna General Hospital, Vienna, Austria*

^c*Department of Urology, University of the Saarland, Homburg, Germany*

^d*Department of Radiotherapy, Barmherzige Schwestern Hospital and St Vincenc Clinic, Linz, Austria*

^e*Division of Clinical Physics, Department of Radiation Oncology, Erasmus MC, Daniel Den Hoed Cancer Center, Rotterdam, The Netherlands*

^f*Department of Urology, AMC, Amsterdam, The Netherlands*

^g*Department of Urology, City Hospital, Kiel, Germany*

Received 3 August 2004; accepted 2 September 2004

Available online 22 October 2004

Prostate brachytherapy in Poland

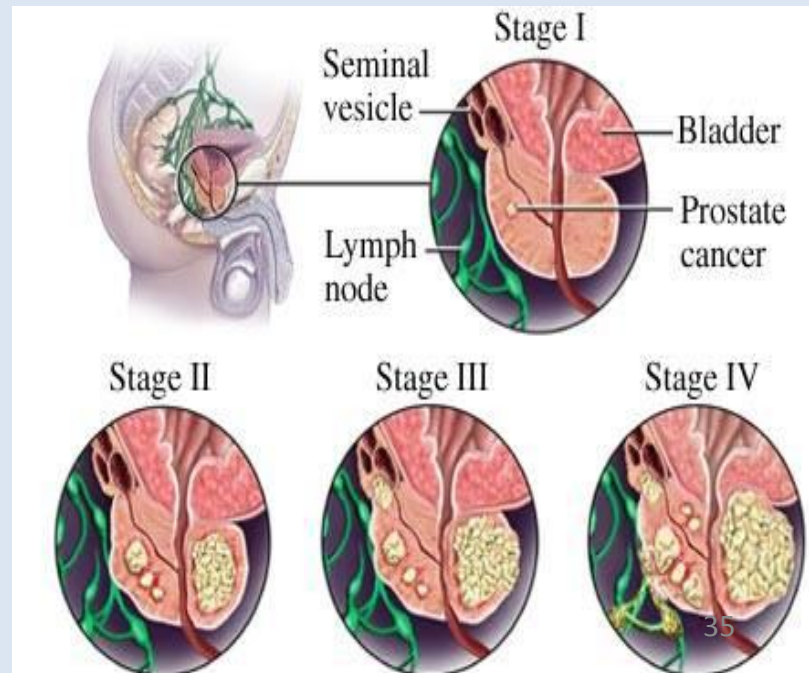
SWIFT 

<i>Centre</i>	<i>2004</i>	<i>2006</i>	<i>2007</i>	<i>2010</i>
Kraków	0	36	36	48
Poznań	0	70	229	307 + seeds (15)
Białystok	0	5	31	36
Gliwice	67	67	44	36
Bydgoszcz	71	107	80	89
Brzozów	43	30	18	0
Kielce	24	30	30	52
Warszawa	93	87	114	94 + seeds (10)
Jastrzębie Zdrój (private)	-	-	-	seeds (14)
Wieliszew (private)				starts HDR 2011
<i>Total</i>	298	432	582	662

Monotherapy (ABS, GEC-ESTRO)

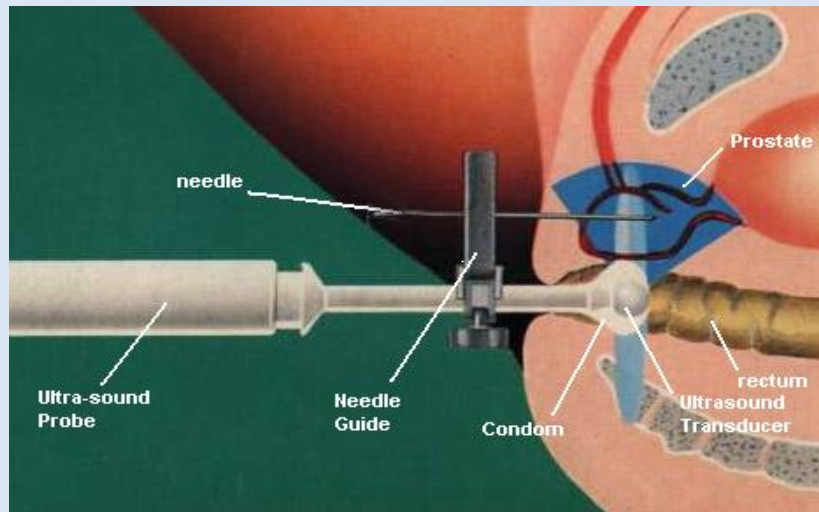
1. T1 i T2,
2. N0,
3. M0,
4. PSA <10, Gleason \leq 6,
5. > 5 years life expectancy

↑
??????????



HDR brachytherapy: diagnostic, equipment, team

➡ similar to seeds



Team in Poznań



Experience in:

- TRUS (done by radiotherapist),
- dosimetry, treatment planning (physicist and radiotherapist),
- needles (seeds) implantation (radiotherapist and physicist),
- radiotherapy knowledge.

Team:

- radiotherapist,
- urologist, radiologist or radiotherapist with ultrasound skills,
- physicist,
- 2-3 nurses,
- anesthetist,
- nurse anesthetic,
- X-ray technician.

Brachytherapy - equipment

High quality - image guided source placement - SWIFT

- High quality digital TRUS with template software,
- Stepper, stepping unit,
- Treatment planning system,
- X-ray/CT for post-implant dosimetry.

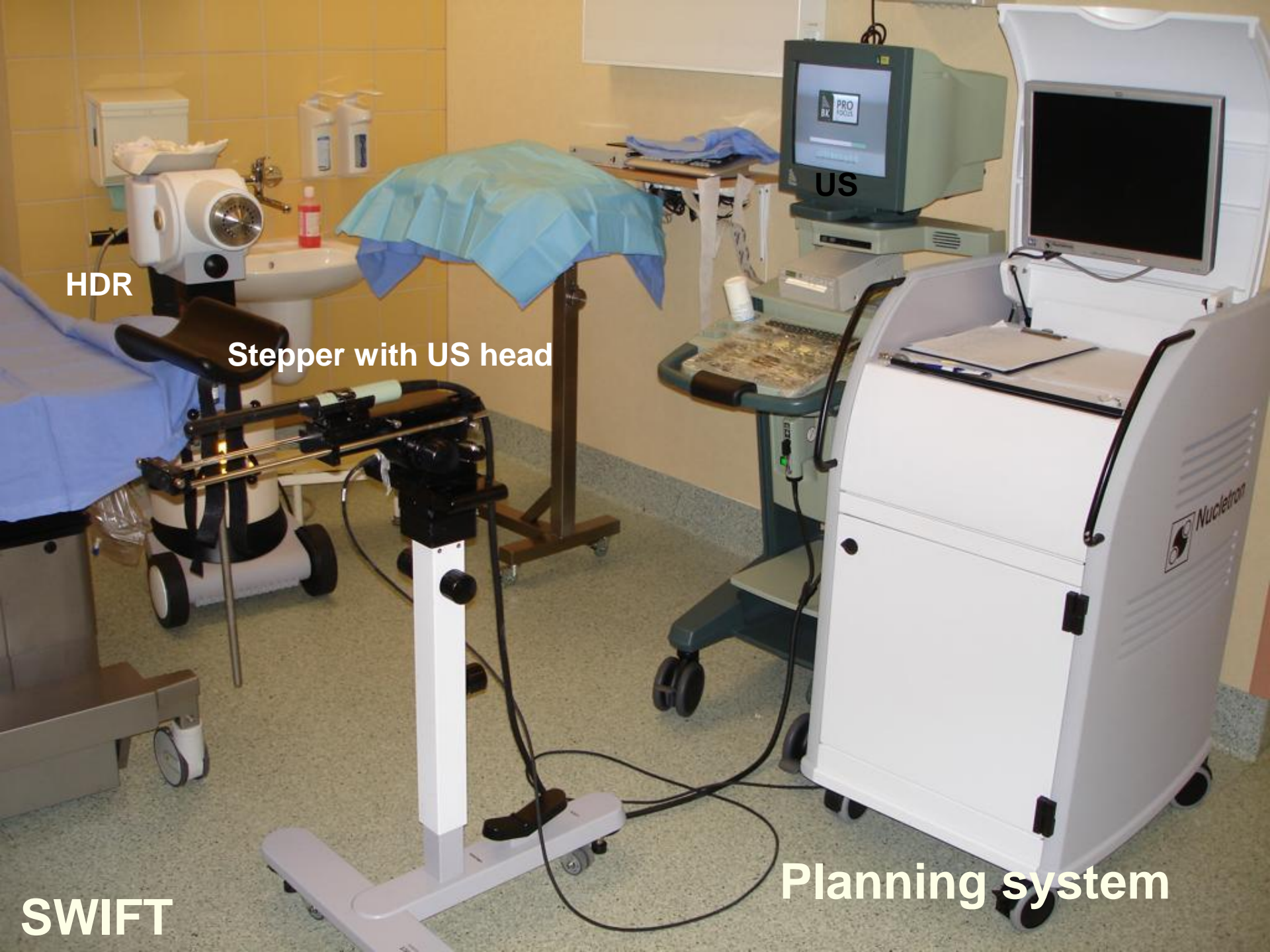
HDR

Stepper with US head

US

Planning system

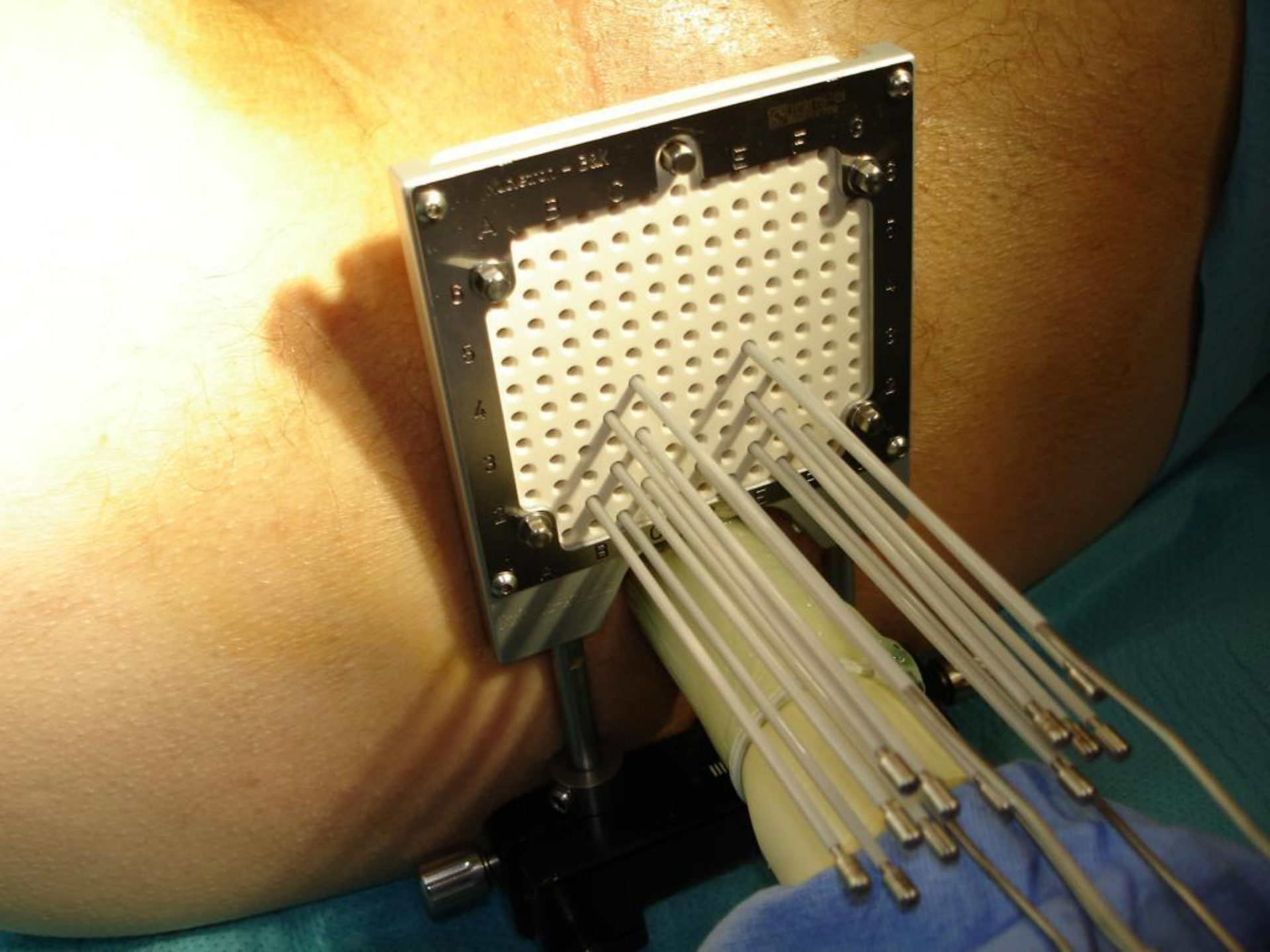
SWIFT

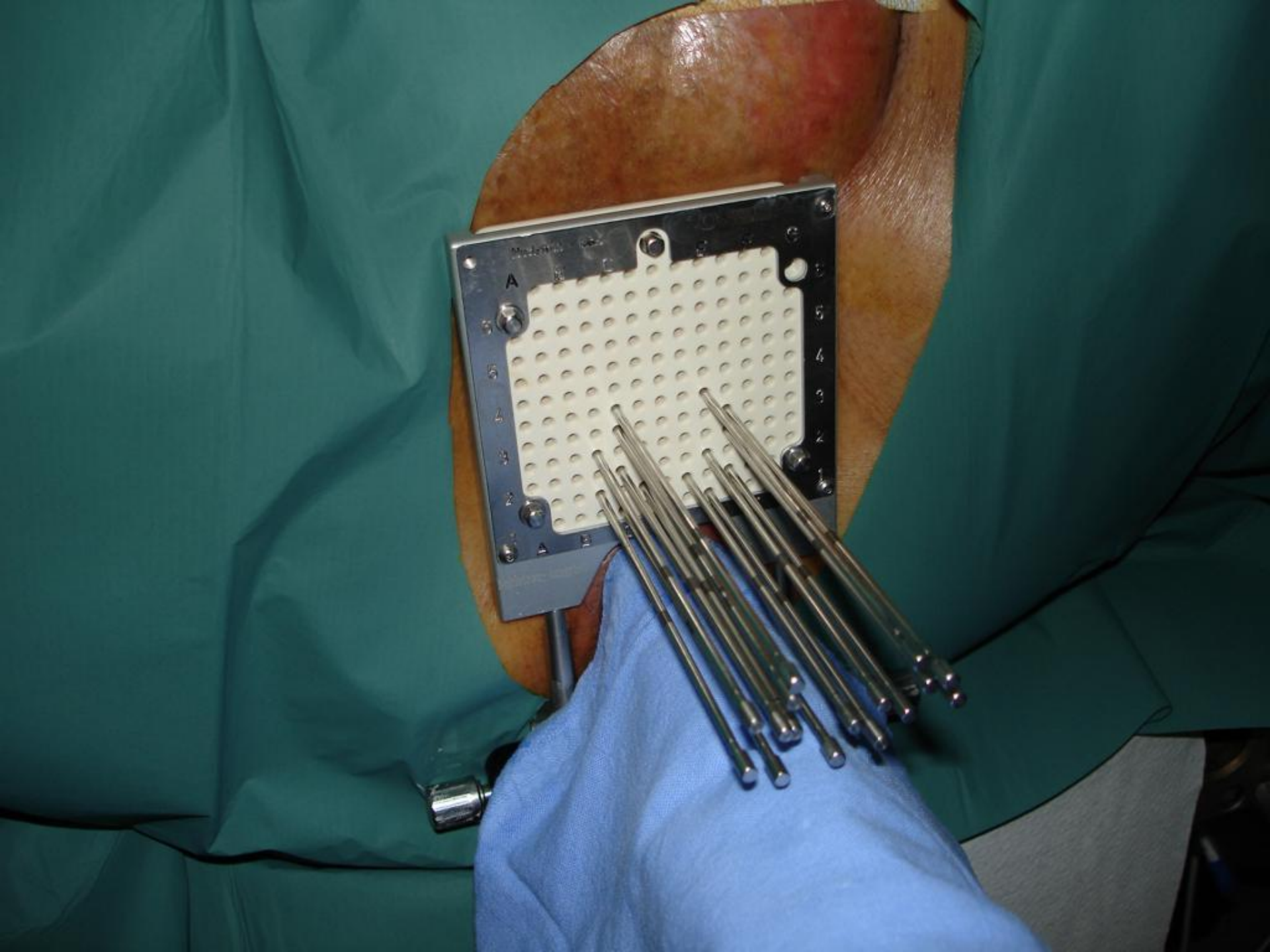




C 05	b 15
E 35	cu 15
C 3	d 15
e 3	e 15
b 25	C 1
e 15	D 1
C 2*	E 1
E 2*	
F 2	









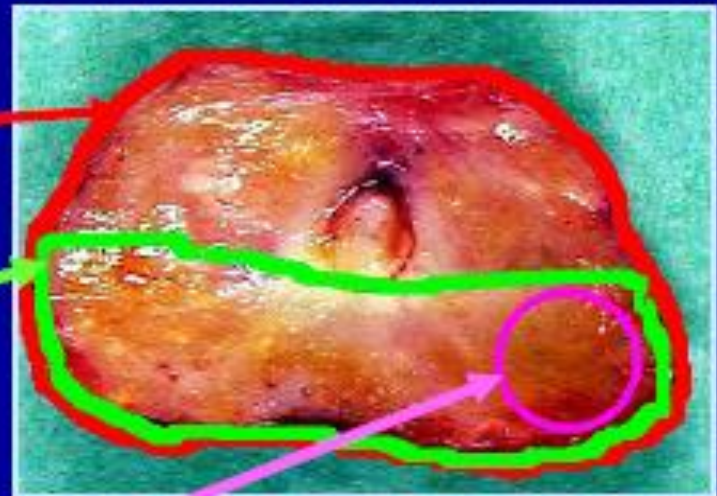
Dose Prescription: IMBRT

Different Target and Treatment Philosophies:

CTV 1 → Prostate Capsule

CTV 2 → Peripheral Zone

CTV 3 → Visible Tumor Infiltration



„Virtual planning”

The software interface displays a 3D model of a prostate and urethra. The main view shows a cross-section with a red contour for the prostate and a yellow contour for the urethra. The Y-value is 52.13 mm. A 3D mode view shows the prostate and urethra in a 3D perspective. The Z-value is -16.56 mm. The X-value is 38.23 mm. A reference plane is shown with a grid of points and labels V1 through V15. A table at the bottom shows the treatment plan parameters for V1 and V2.

#	Column	Row	Indexer[mm]	Depth[mm]	Free Len. [mm]	Offset[mm]	Tip-1stSDP[mm]	Layout
V1	C	3	1408.00	0.25	104.75	-9.75	10.00	
V2	E	3	1408.00	0.25	104.75	-9.75	10.00	

Y-Value = 52.13 mm
 Z-Value = -16.56 mm
 X-Value = 38.23 mm

Prostate
 Urethra

REFERENCE PLANE

Prostate
 Urethra

V1 V2
 V3 V4
 V5 V6
 V7 V8
 V9 V10
 V11 V12
 V13 V14
 V15

Contouring

Set Contour

Draw

Segmental Continuous

Define Radius 3.65 [mm]

Manual Auto Margin

Edit Contour

Copy Paste

Modify Clear Current

Use Interpolated

Edit VOI

Modify Clear Current

Clear All

Export VOIs

Define VOI

Prostate Urethra Rectum

New Options Delete

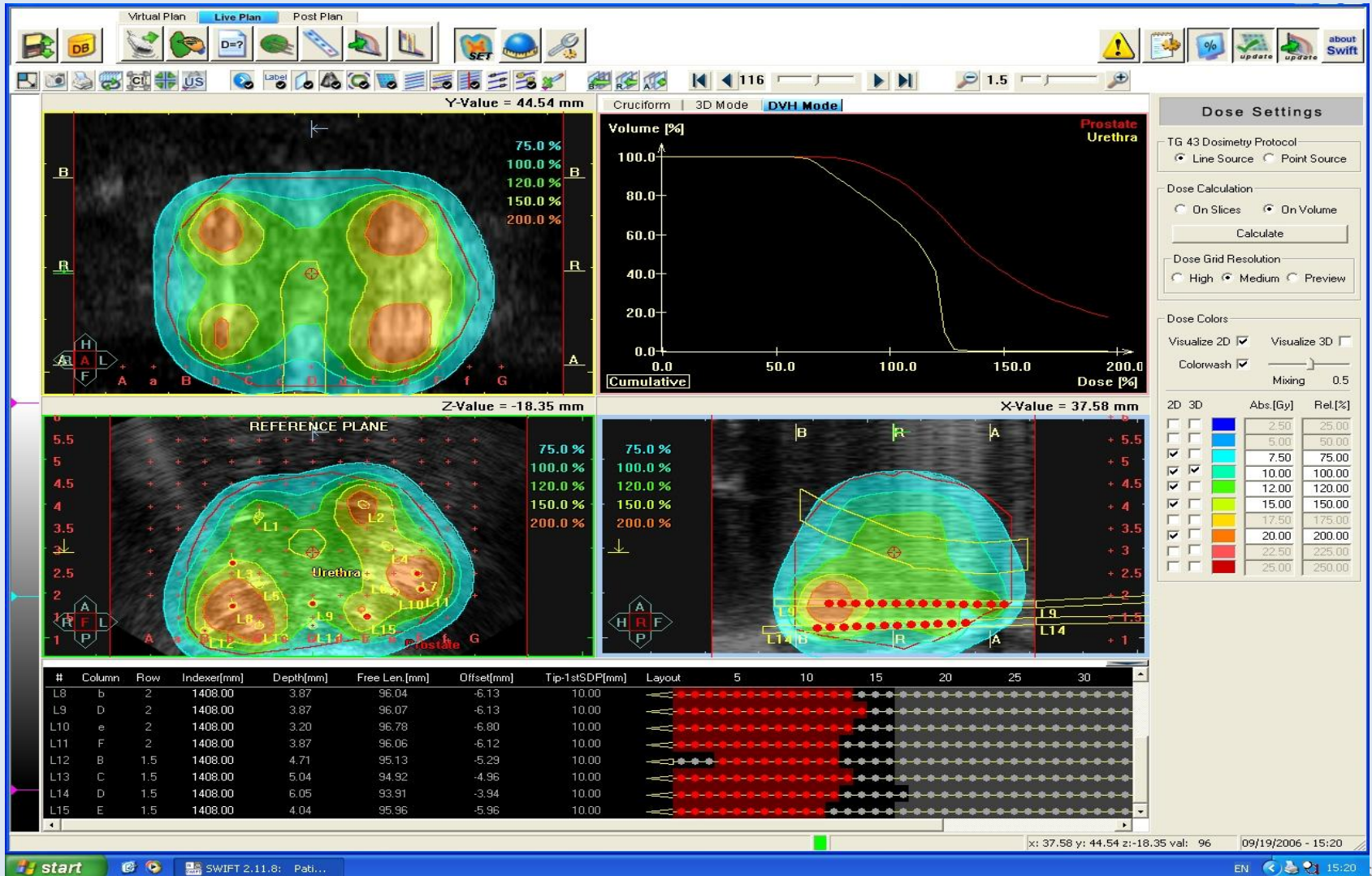
VOI Intersections

Check Intersections

Prostate - Urethra

start SWIFT 2.11.8: Pati... EN 08:06

„Real-time planning“



CLINICAL INVESTIGATION

Prostate

**AMERICAN BRACHYTHERAPY SOCIETY (ABS) RECOMMENDATIONS FOR
TRANSPERINEAL PERMANENT BRACHYTHERAPY OF PROSTATE CANCER**

SUBIR NAG, M.D.,*[†] DAVID BEYER, M.D.,*[‡] JAY FRIEDLAND, M.D.,*[§] PETER GRIMM, D.O.,*^{||} AND
RAVINDER NATH, PH.D.*[¶]

*Prostate Brachytherapy Quality Assurance Group, Clinical Research Committee, American Brachytherapy Society, Reston, VA;
[†]The Ohio State University, Columbus, OH; [‡]Arizona Oncology Services, Phoenix, AZ; [§]Moffitt Cancer Center, Tampa, FL;
^{||}Swedish Medical Center, Seattle, WA; and [¶]Yale University, New Haven, CT

Brachytherapy as a Boost to EBRT:

- T2b, T2c or
- Gleason 8-10 or
- PSA > 20 ng/ml

Other possible indications for Brachytherapy as a Boost to EBRT:

- Perineural invasion,
- Multiple positive biopsies, bilateral positive biopsies,
- MRI positive for capsular penetration.

Brachytherapy (including Boosting EBRT) in Conjunction with Androgen Deprivation:

- Patients with initially large prostate (>60 cc) that have downsized sufficiently

Brachytherapy in Poland - 2011

Permanent



ELSEVIER

Int. J. Radiation Oncology Biol. Phys., Vol. 44, No. 4, pp. 789-799, 1999

Copyright © 1999 Elsevier Science Inc.

Printed in the USA. All rights reserved

0360-3016/99/\$-see front matter

PII S0360-3016(99)00069-3

CLINICAL INVESTIGATION

Prostate

AMERICAN BRACHYTHERAPY SOCIETY (ABS) RECOMMENDATIONS FOR TRANSPERINEAL PERMANENT BRACHYTHERAPY OF PROSTATE CANCER

SUBIR NAG, M.D.,*[†] DAVID BEYER, M.D.,*[‡] JAY FRIEDLAND, M.D.,*[§] PETER GRIMM, D.O.,*^{||} AND
RAVINDER NATH, PH.D.*[¶]

*Prostate Brachytherapy Quality Assurance Group, Clinical Research Committee, American Brachytherapy Society, Reston, VA;

[†]The Ohio State University, Columbus, OH; [‡]Arizona Oncology Services, Phoenix, AZ; [§]Moffitt Cancer Center, Tampa, FL;

^{||}Swedish Medical Center, Seattle, WA; and [¶]Yale University, New Haven, CT



ELSEVIER

Radiotherapy and Oncology 57 (2000) 315–321

RADIOTHERAPY
& ONCOLOGY

JOURNAL OF THE EUROPEAN SOCIETY FOR
THERAPEUTIC RADIOLOGY AND ONCOLOGY

www.elsevier.com/locate/radonline

ESTRO/EAU/EORTC recommendations on permanent seed implantation for localized prostate cancer

Daniel Ash^{a,*}, Anthony Flynn^a, Jan Battermann^b, Theodoros de Reijke^c,
Paulo Lavagnini^d, Leo Blank^e

^a*Department of Clinical Oncology and Medical Physics, Cookridge Hospital, Leeds, UK*

^b*Department of Radiotherapy, Academisch Ziekenhuis, Utrecht, Germany*

^c*Department of Urology, Academisch Medisch Centrum, Amsterdam, The Netherlands*

^d*Instituto Tumori, Genoa, Italy*

^e*Department of Radiotherapy, Free University, Amsterdam, The Netherlands*

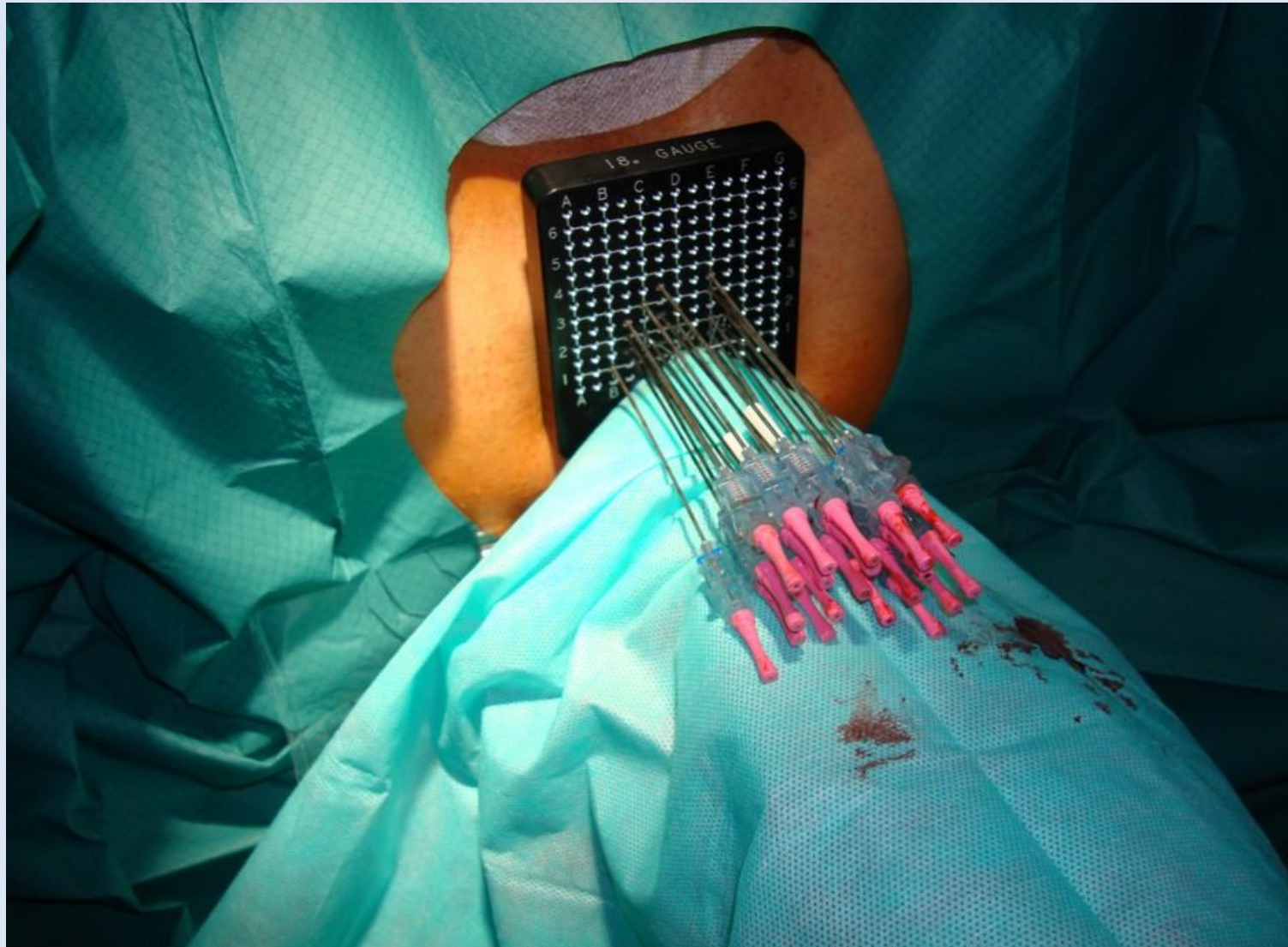
Received 18 September 2000; accepted 27 September 2000



Example of seed



Utrecht technique – used in 2008-2009



Seeds - producers

Greatest:

1. McMaster University's Reactor (Canada),
2. National Research Universal (NRU) Reactor (Canada)

1. IsoRay Medical™, Cesium-131
2. Best Medical International, Inc.
Best Industries Iridium (Ir 192)
3. Theragenics TheraSeeds
Iodine-125, Palladium-103
4. Amersham Healthcare Iodine (I-125)

1. IBt Bebig
2. Nucletron
3. Varian VariSeed
4. Oncura RAPID Strand
5. BARD ProSeed
6. IsoAid

Doses:

I-125 monotherapy 140-160 Gy (144-145 Gy)

I-125 + 40-50 Gy EBRT 100-120 Gy

Pd-103 monotherapy 110-120 Gy (125 Gy)

Pd-103 + 50 Gy EBRT 60-90 Gy

Cs-131 monotherapy 115 Gy

Greater Poland Cancer Centre

18.12.2008 – 19.01.2011

57 patients (50 – 82 years)

43 – Rapid Strands (USA); 14 – BEBIG (Germany)

Age:	
50 – 59	17
60 – 69	28
70 – 79	10
≥ 80	2

Median: 63.8 years

55 patients – monotherapy

2 patients – recurrence after EBRT

T1 – 32

T2 – 25

Gleason:

≤ 6 – 45

7 – 12

PSA: median 9.2 ng/ml

< 10 ng/ml - 44

> 10 ng/ml - 13

Median seeds number - 53

Range: 30 – 82

21 patients – 40 - 50

18 patients – 51 - 60

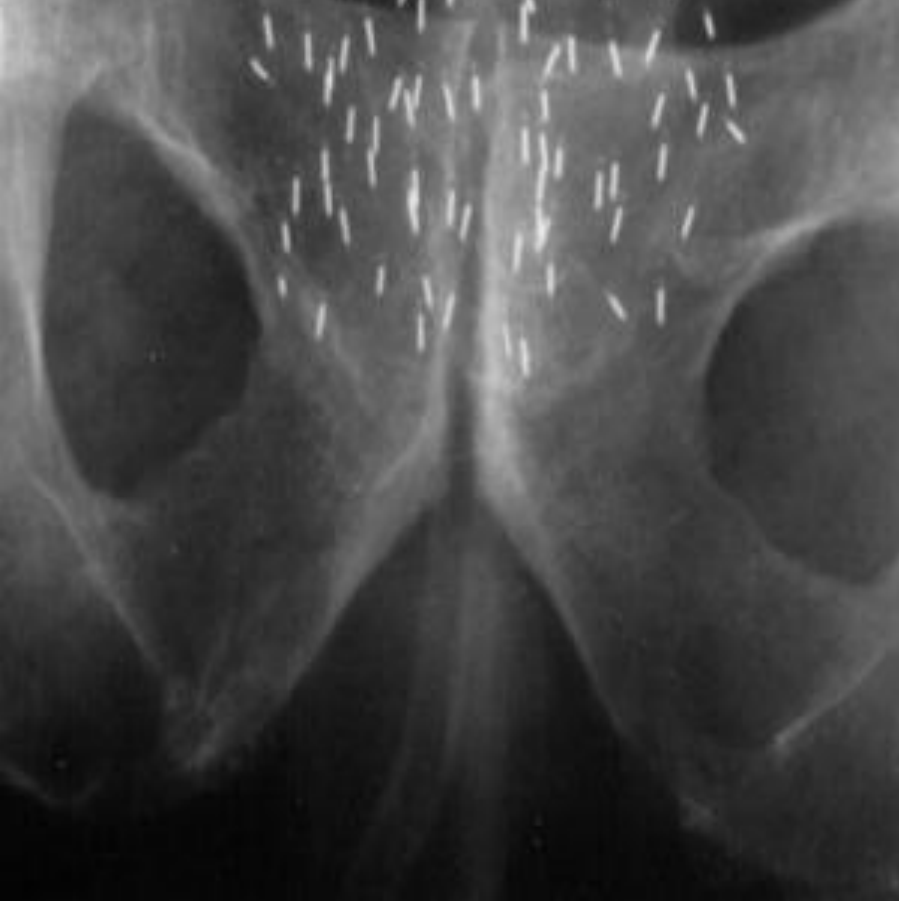
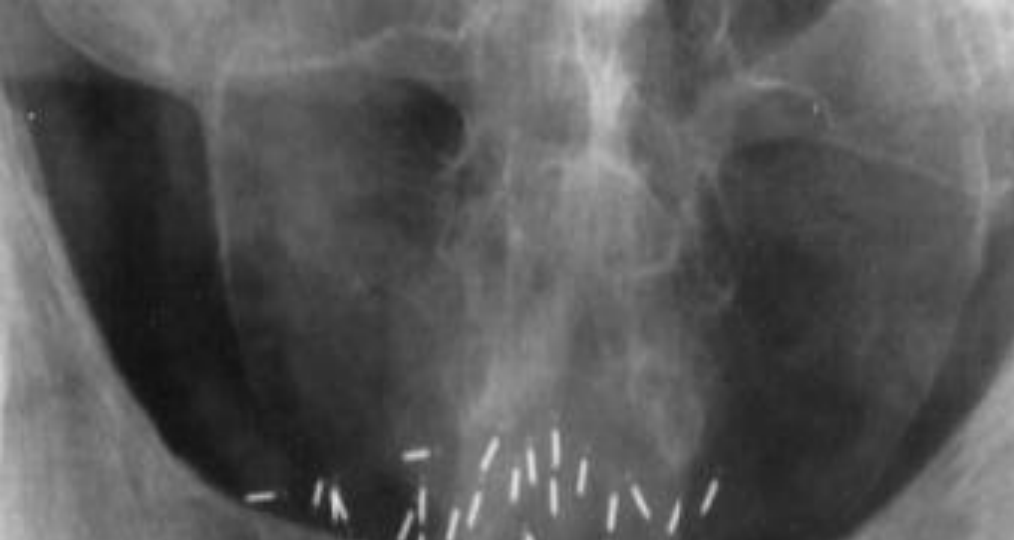
Median needles number: 23

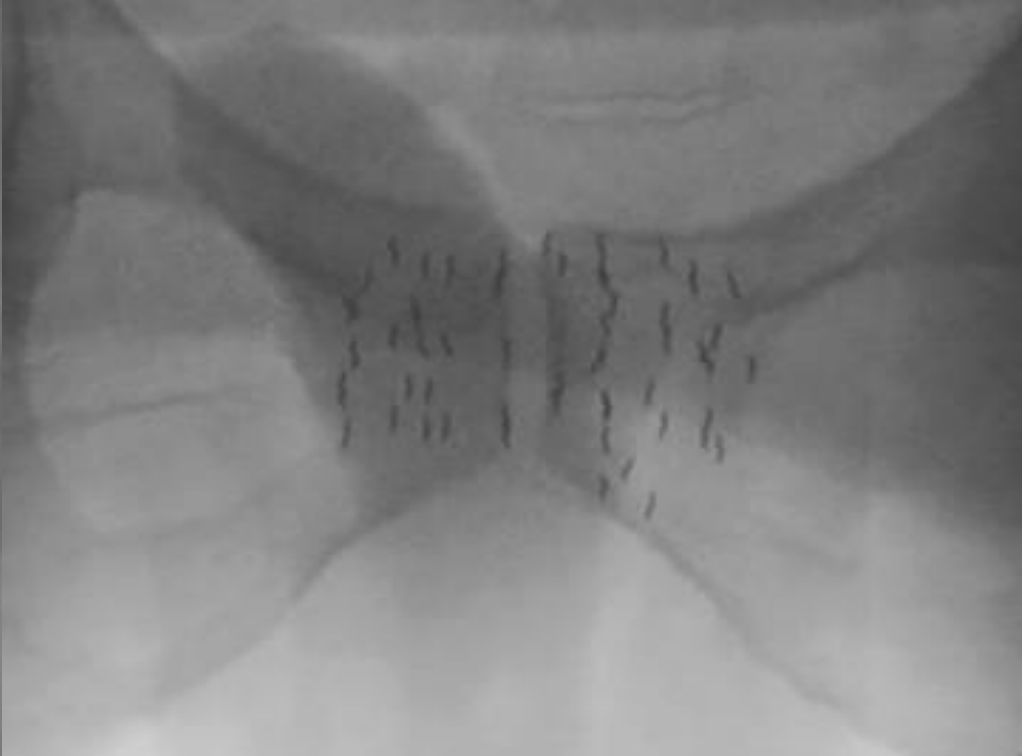
Range: 15 – 34

Median prostate volume: 32.5 cm³

Range: 14 – 62 cm³

Severe complications: 1 patients – urinary retention



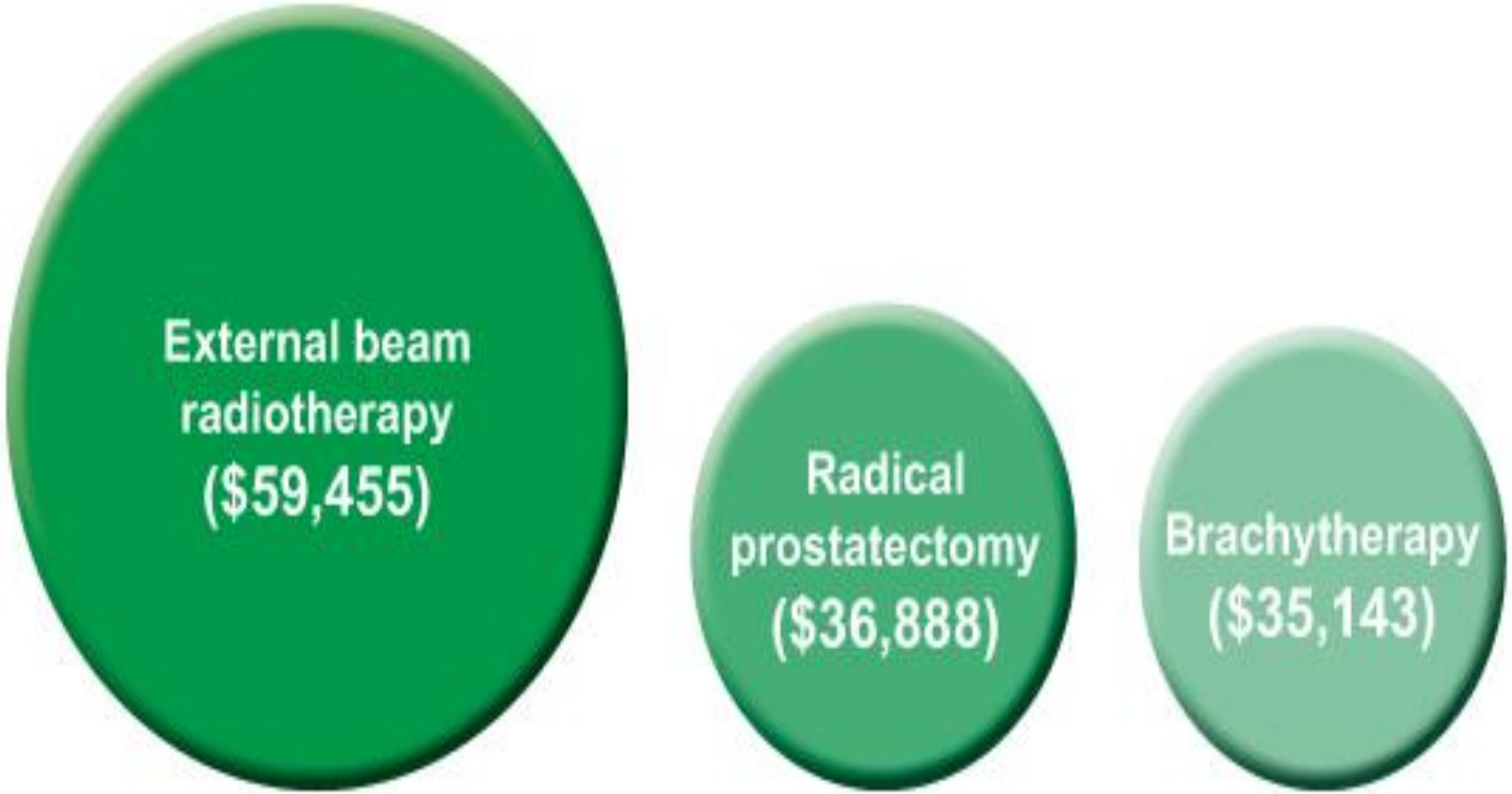


Post implant dosimetry

It is usual to perform the CT scan 4 ± 6 weeks after implantation when oedema has settled.

It is recommended that the following indices are recorded for all patients:

1. The volume implanted.
2. The number of seeds.
3. The number of needles used.
4. The total activity implanted.
5. The prescribed dose.
6. The **D90**, that is the dose that covers 90% of the prostate volume as defined from post implant imaging.
7. The **V100**, that is the percentage of the prostate volume that has received the prescribed dose.
8. **V150**, the volume that has received 50% more than the prescribed dose.



External beam
radiotherapy
(\$59,455)

Radical
prostatectomy
(\$36,888)

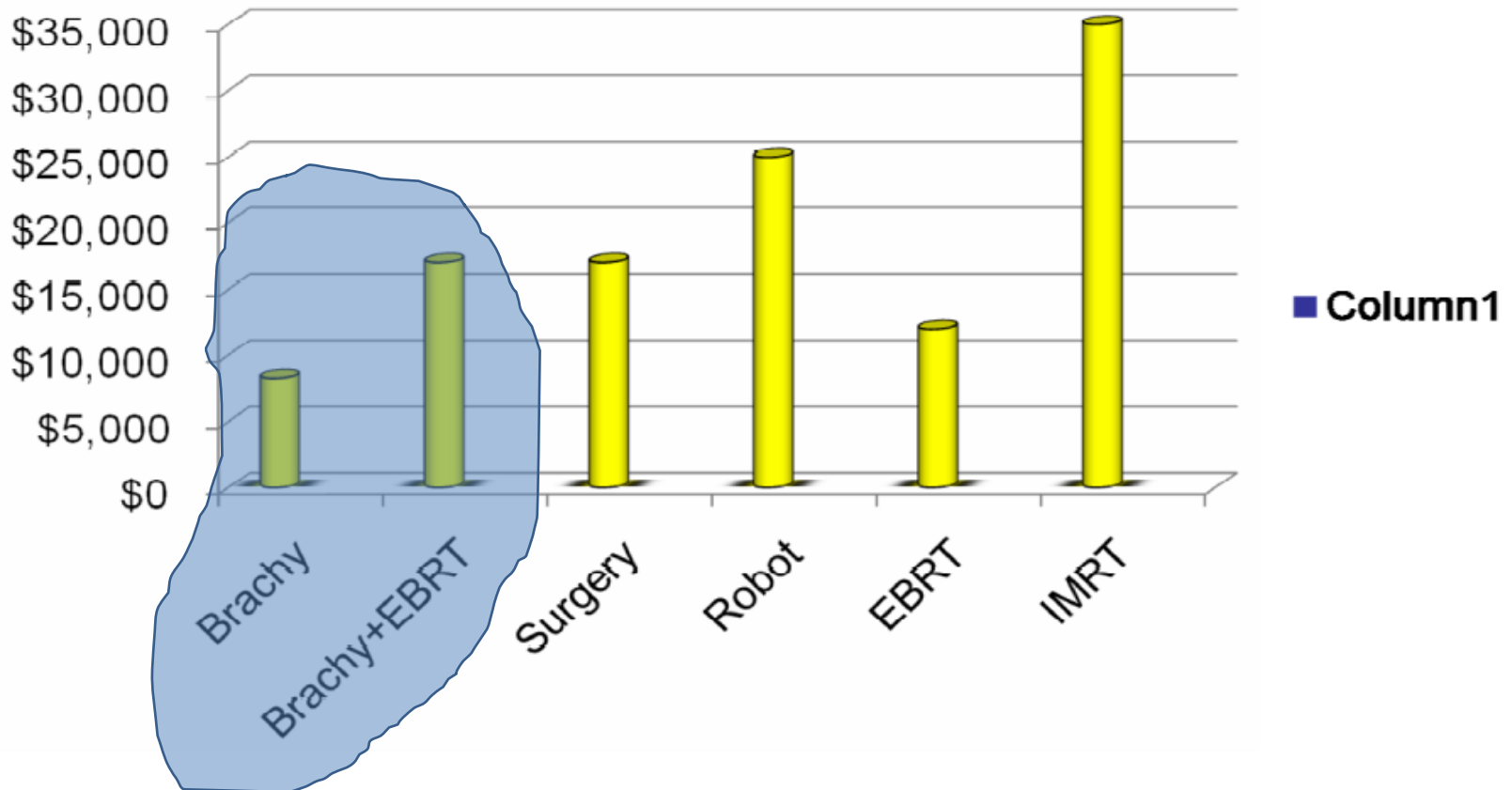
Brachytherapy
(\$35,143)

Cumulative treatment costs over five and a half years
for patients with newly-diagnosed prostate cancer.¹⁴

Costs

P-BIG Prostate Brachytherapy International Group

Luis A. Linares MD FACRO, EJGH, LA



Seeds

Sole LDR brachytherapy: Advantages

- good treatment results (similar to surgery) ^{1,2}
 - relatively small rate of complications
 - short treatment time (1-3 days)

Disadvantage

- in the past – seed migration possibility
- small risk of relatives irradiation
 - costs

1) Sylvester, J. E., P. D. Grimm, et al. (2010). "Fifteen-Year Biochemical Relapse-Free Survival, Cause-Specific Survival, and Overall Survival following I(125) Prostate Brachytherapy in Clinically Localized Prostate Cancer: Seattle Experience." *Int J Radiat Oncol Biol Phys*

2) Ragde, H., L. J. Korb, et al. (2000). "Modern prostate brachytherapy. Prostate specific antigen results in 219 patients with up to 12 years of observed follow-up." *Cancer* **89**(1): 135-41.

HDR

Advantages

- good treatment results (similar to seeds) ^{1,2}
 - possibility of dose verification
 - complications similar to ¹⁾
 - positive radiobiology
 - no staff exposure to radiation

Disadvantage

- different fractionation schemas
- in monotherapy – small trial's number

1) Demanes, D. J., A. A. Martinez, et al. (2011). "High-Dose-Rate Monotherapy: Safe and Effective Brachytherapy for Patients with Localized Prostate Cancer." *Int J Radiat Oncol Biol Phys*.

2) Mark, R. J., P. J. Anderson, et al. (2010). "Interstitial High-Dose-Rate Brachytherapy as Monotherapy for Early Stage Prostate Cancer: Median 8-Year Results in 301 Patients " *Brachytherapy* **9**(Supplement 1): S76.



**Thank you
for your
attention**