Prostate Cancer Treatments

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A Brief History of Radiation

- Wilhelm Roentgen discovered *X-rays* on November 8, 1895, while experimenting with a gas-filled cathode tube
  - He noted an image of the bones of his hand projected on a screen when placed between the tube and the fluorescent screen

- **He called this X-ray**

Early radiograph taken by Roentgen, January, 1896.

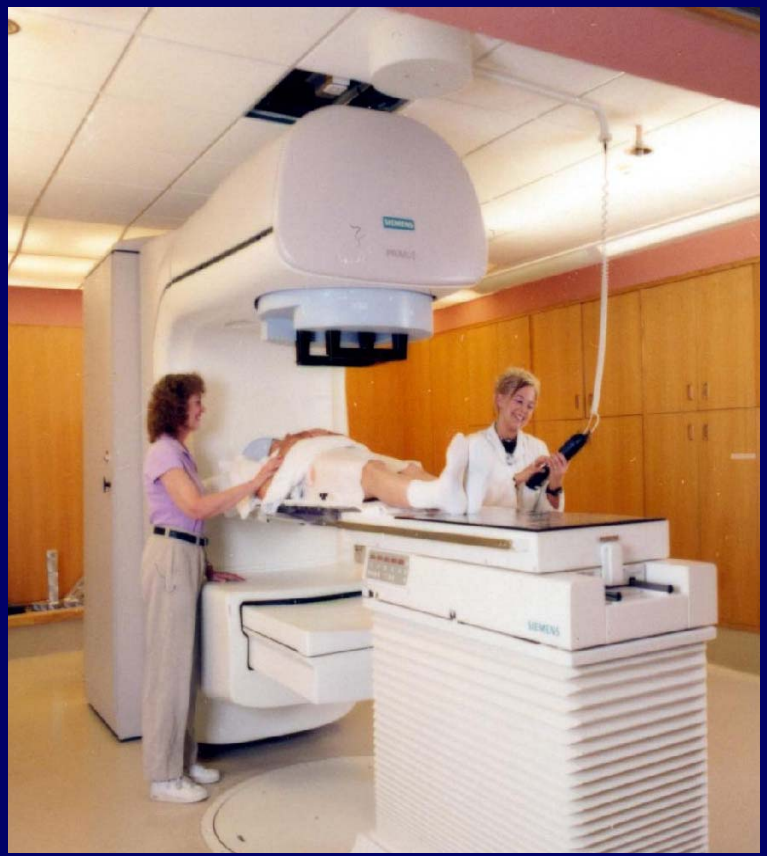
Brief History of Radiation Therapy

- The first patient was treated with radiation in 1896, two months after the discovery of the X-ray.
- Rapid technology advances began in the early 1950s with cobalt units followed by linear accelerators a few years later.
- Recent technology advances have made radiation more effective and precise.

Process of Care: Delivery of Radiation Therapy

- Radiation therapy can be delivered two ways
  - ***External beam*** radiation therapy typically delivers radiation using a linear accelerator
  - **Internal radiation** therapy, called *brachytherapy*, involves placing radioactive sources into or near the tumor

How Is Radiation Therapy Used?



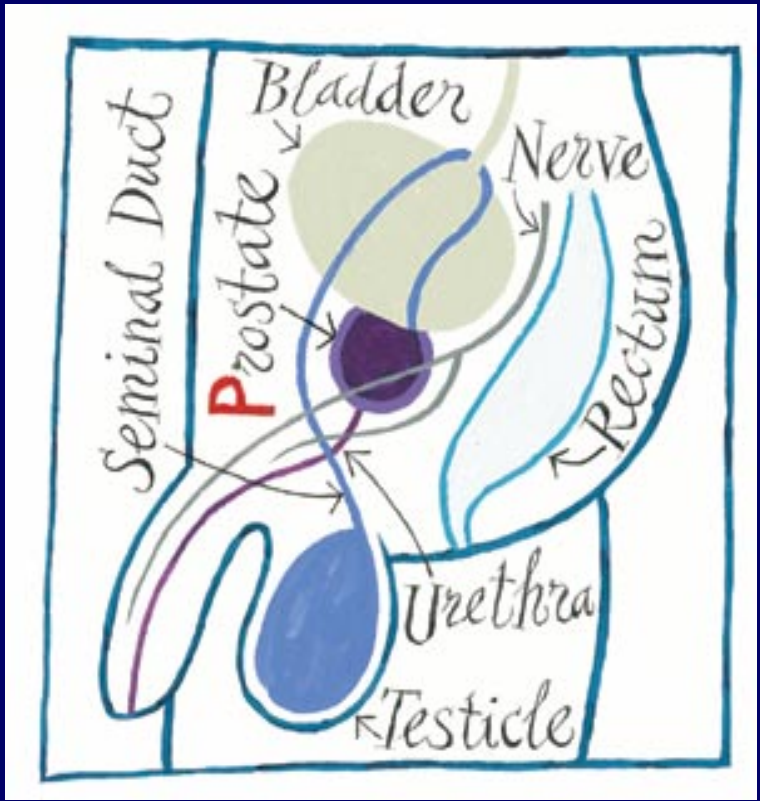
Radiation therapy is used two different ways.

- **To cure prostate cancer:**
  - Destroy tumors that have not spread to other body parts.
  - Reduce the risk that cancer will return after surgery or chemotherapy.

- **To reduce symptoms of cancer:**
  - Shrink tumors affecting quality of life, like a lung tumor that is causing shortness of breath.
  - Alleviate pain by reducing the size of a tumor.

Prostate Cancer

Prostate Cancer



- **Prostate is surrounded – by the bladder, rectum, and urethra. The prostate is encircled by tissues and nerves - easily damaged during treatments – damage that can lead to cystitis, proctitis, impotence and incontinence.**

Pollack et al 2002/ 3DCRT

- FFF/OS results at 6 yrs

Doses	PSA	PSA	all	OS
	≤ 10	> 10	pt	all
	(%)	(%)	(%)	(%)
70 Gy	75	43	64	87
78 Gy	75	62	70	90
p value	ns	0.01	0.03	0.67

Int J Radiation Oncol Biol Phys: 53 (5), 1097, 2002

Pollack et al 2002/ 3DCRT

- Late toxicity results at 6 yrs

Doses	Rectal	Bladder
	gr ≥ 2 (%)	gr ≥ 2 (%)
70 Gy	12	10
78 Gy	26	10
p value	0.001	ns

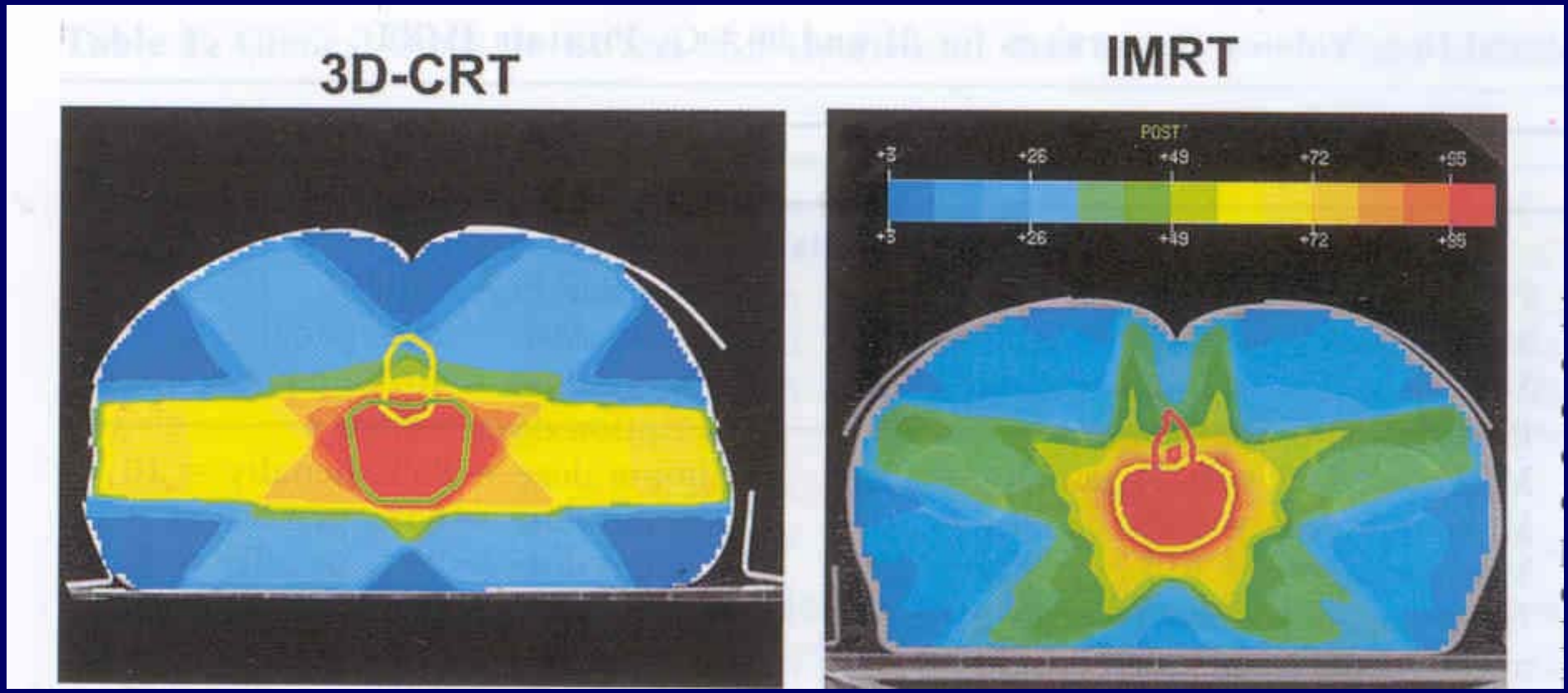
Int J Radiation Oncol Biol Phys: 53 (5), 1097, 2002

Teh et al., 1999

- IMRT is a new technology in RT that delivers radiation precisely to the tumor while relatively sparing the surrounding normal tissues.

The Oncologist:4, 433, 1999

Zelefsky et al 2002/ IMRT



Seminars in Radiation Oncology:12(3), 229, 2002

Zelefsky et al 2002/ IMRT

- Reslts: acturial PSA free survival
- Median f/u 24 m (6 - 60 m)

Risk	3D CRT	3DCRT	**IMRT**
group	64.8-70.2 Gy	75.6-86.4 Gy	**81- 86.4 Gy**
	at 5 yrs (%)	at 5 yrs (%)	**at 3 yrs (%)**
fav	77	90	**92**
int	50	70	**86**
unfav	21	47	**81**

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Zelefsky et al 2002/ IMRT

- Reslts: acute and late toxicity
- Median f/u 24 m (6 - 60 m)

Tox grade	acute GI (%)	late GI (%)	acute GU (%)	late GU (%)
0	74	89	33	74
1	22	9	38	16
2	4	1.5	28	9.5
3	0	0.5	1	0.5

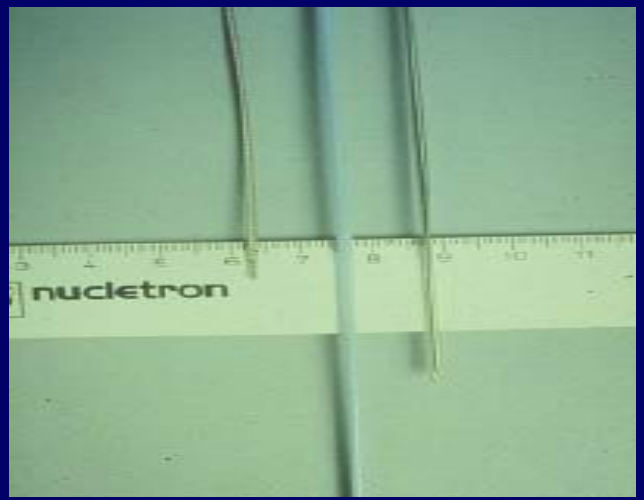
Int J Radiation Oncol Biol Phys: 53 (5), 1111, 2002

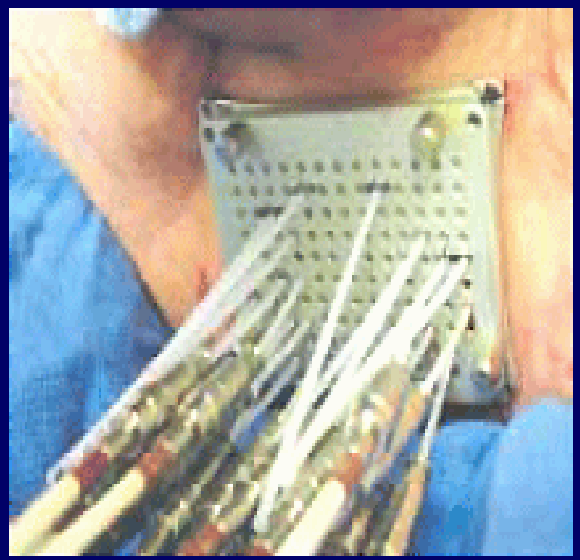
Conclusions/ Prostate

- IMRT can improve Prostate Cancer outcome.
- IMRT reduced GI toxicity in prostate cancer pts

High Dose Rate/ Prostate Cancer

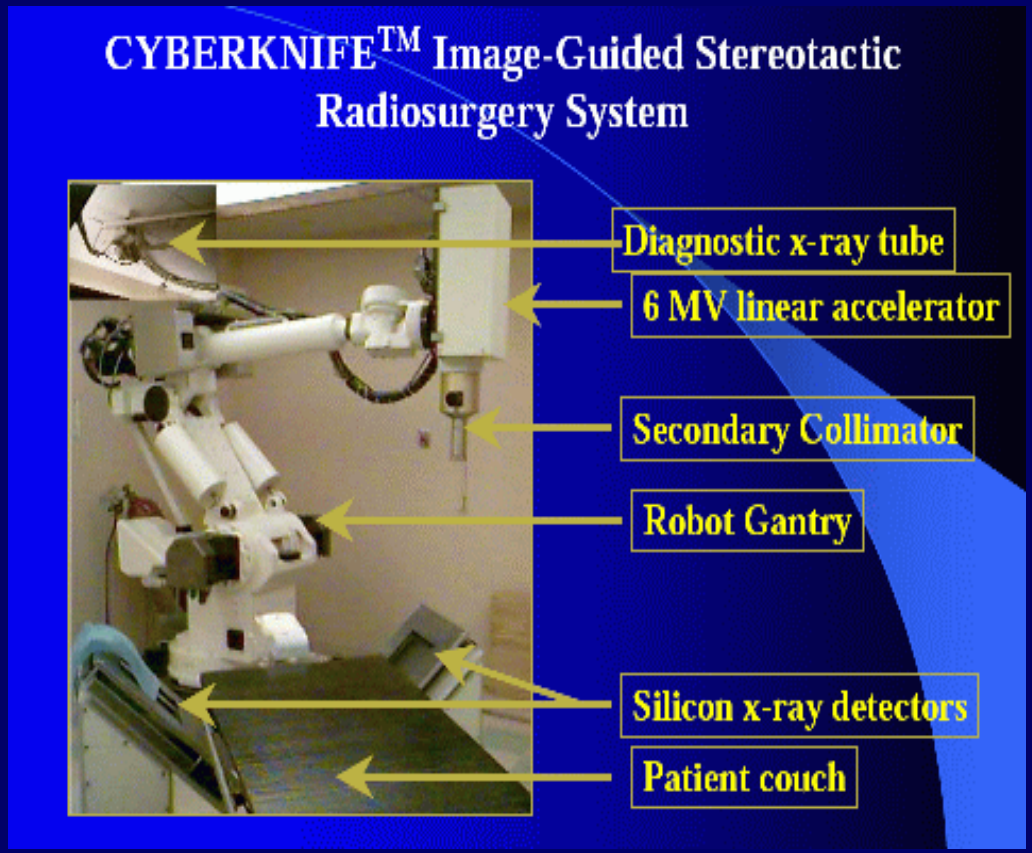
- Temporary High Dose Rate (HDR) brachytherapy technique, commonly dubbed as ‘smart bomb’ is being popularized.





Cyber Knife

- Cameras on the ceiling act as eyes -Map out movement caused by pts breathing
- Accuracy humans cannot achieve – sub millimeter
- The design came from the automotive industry



Gene therapy/ Prostate Cance

- Replacement of mutated tumor-suppressor gene
- Introduction of effector gene stimulating body's immune response
- Suicide gene activating pro drug into toxic chemotherapy
- **Gene injected before surgery**
- **Combination treatment involving the gene therapy with IMRT to see which treatment is most effective.**

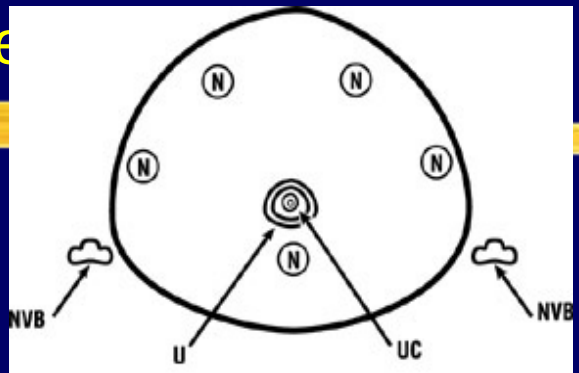


Fig 1. — Transverse section of a prostate showing the positions of 2 anterior and 3 posterior needles for p53 injection (N = needle for p53 injection, NVB = neurovascular bundle, U = urethra, UC = urethral catheter).

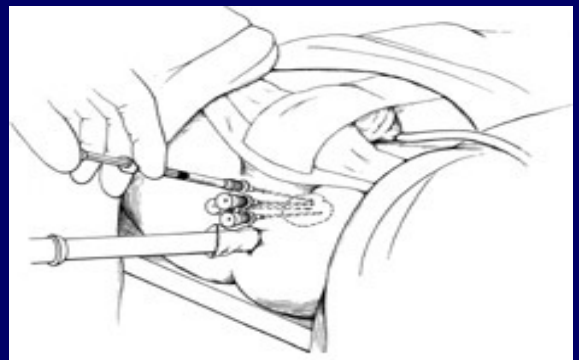
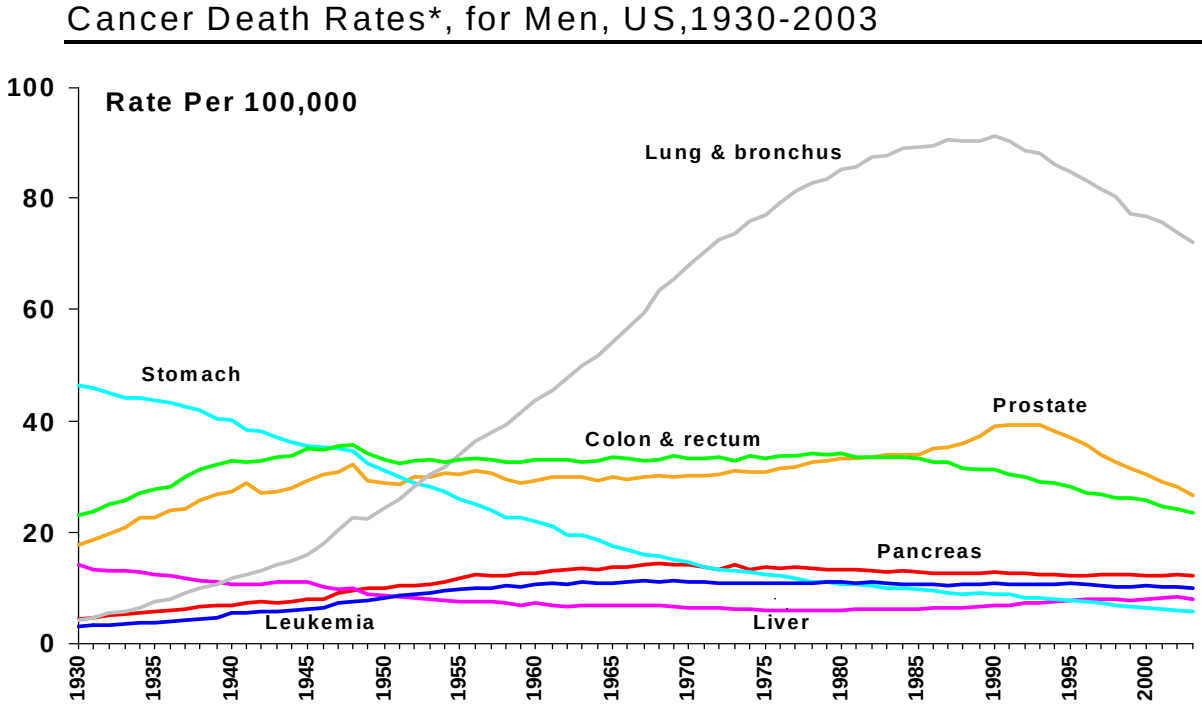


Fig 2. — The p53 gene in adenoviral vector is being injected into the prostate. During the injection, the needle is withdrawn from the base to the apex of the prostate to facilitate as extensive a distribution of vector as possible.

Cancer death rates 1930-2003



*Age-adjusted to the 2000 US standard population.
Source: US Mortality Public Use Data Tapes 1960-2003, US Mortality Volumes 1930-1959, National Center for Health Statistics, Centers for Disease Control and Prevention, 2006.

Conclusions

- Prostate cancer treatments require a multi-modality management including surgery, chemotherapy and radiation.

- Each prostate cancer pt should be consulted by all specialty, including a radiation oncologist.

Conclusions

- IMRT is the latest radiation therapy technique for prostate cancer patients.
  - Higher cure rate/lower side effects for prostate cancer pt

Conclusions

- Newest prostate cancer therapy
  - Robotic surgery for prostate cancer pts
  - Chemo and hormone therapy for prostate cancer pts
  - HDR radiation therapy for prostate cancer pts
  - Robotic radiation Cyber Knife for prostate cancer pts
  - Gene therapy for prostate cancer pts

Conclusions

- Prostate Cancer treatments have come a long way in last 100 yrs, now actively contributing to cure of cancers.

Conclusions

- Still many treatments are on the horizon and will continue to be developed until prostate cancer, like polio and smallpox, one day is a distant memory.