PROSTATE BRACHYTHERAPY
UK & Ireland Conference 2015

Prostate Brachytherapy in Leeds
20 years experience

Brendan Carey

Cookridge Hospital

1995

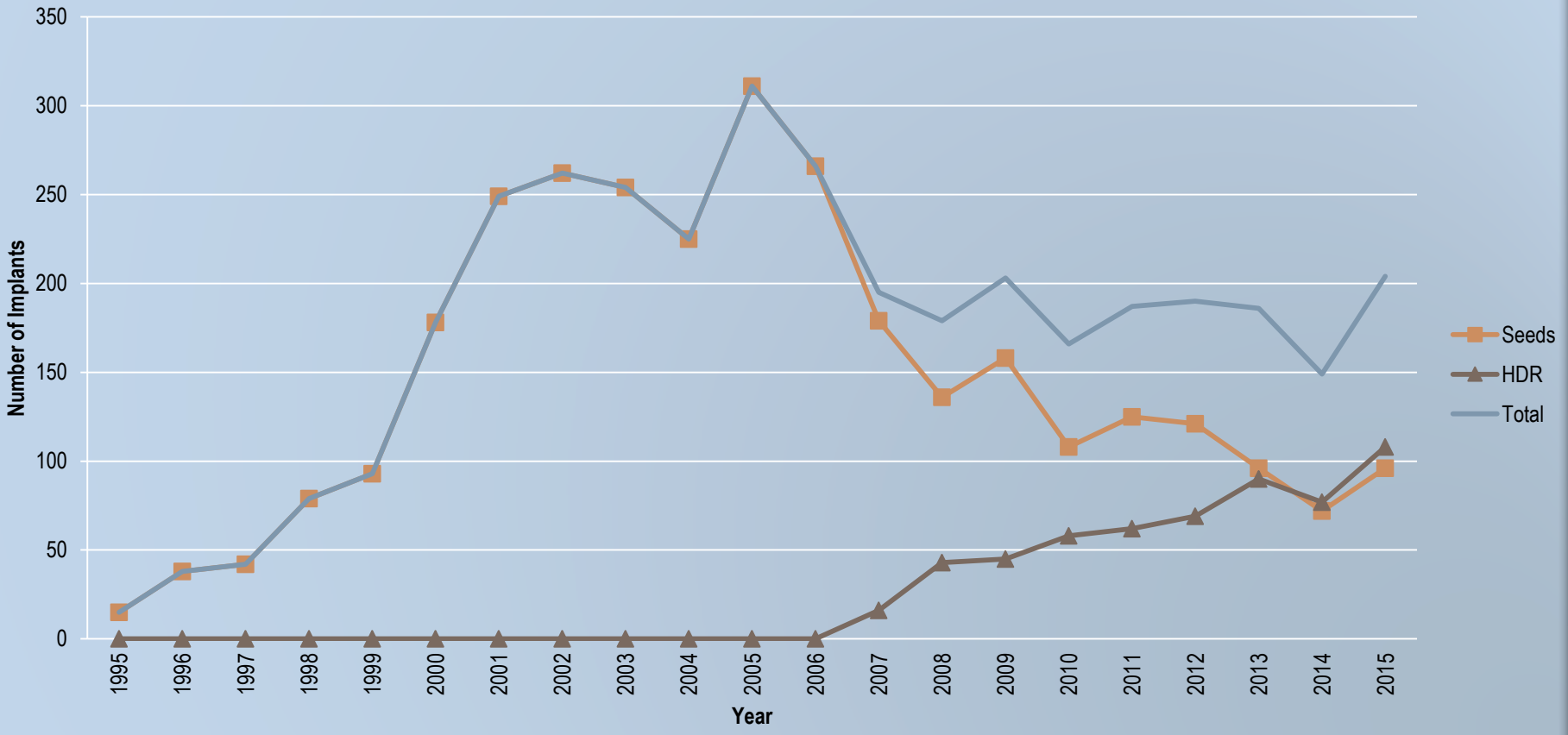
400+ HDR implants

2015

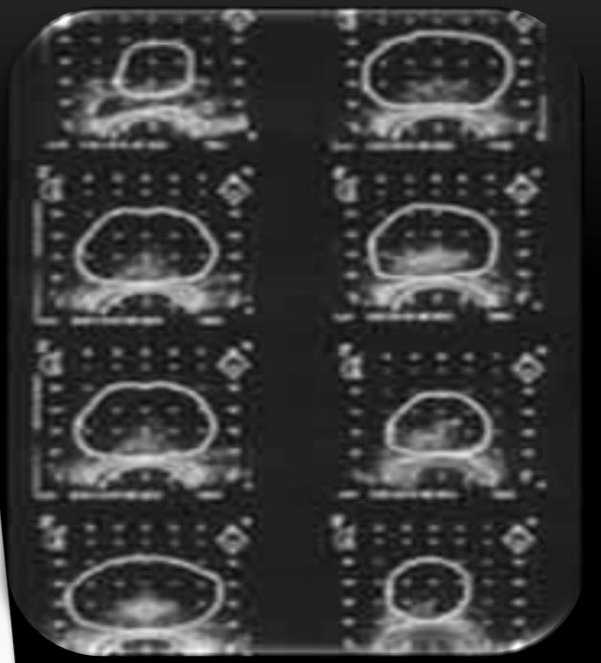
3000+ LDR implants

Institute Oncology
St James Hospital

Prostate Brachytherapy
Leeds 1995 - 2015



The expert in anything was once a beginner.



Seattle Brachytherapy Course
1994

"Business Case" -1995 style

PROSTATE BRACHYTHERAPY

It is intended to start a programme of brachytherapy treatment for early prostate cancer but before doing so it is necessary to identify the best indications for treatment and the most appropriate of the different techniques so far described.

1. **Identification of Suitable Patients for Treatment**

   Stage T1, T2, N0, M0.
   Patients to be staged by bone scan, CT, PSA, chest x-ray.

2. **Treatment Exclusions**

   Age greater than 75.
   Significant prior TURP.
   Size greater than 45 to 50 gms.
   Retropubic extension.

3. **Pre-Brachytherapy Workup**

   This is necessary to assess the tumour volume. The position of the implant catheters and the number of sources required.
   This can be done either by

"Number 1"

69 year old

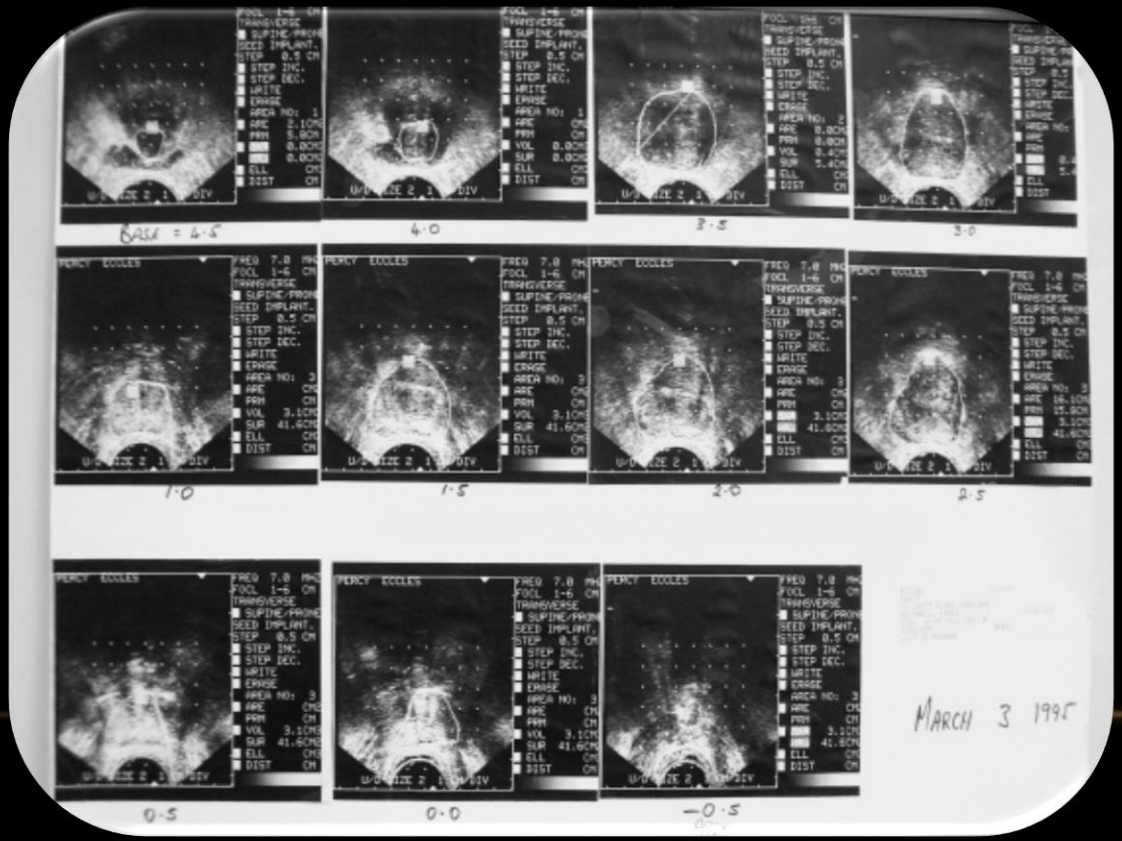
PSA of 24

Gleason 7 on TRUS biopsy

Clinically T2

TRUS Volume 48cc.

I^{125} Implant on March 31 1995



135 mls

SURGEON

OPERATION NOTES

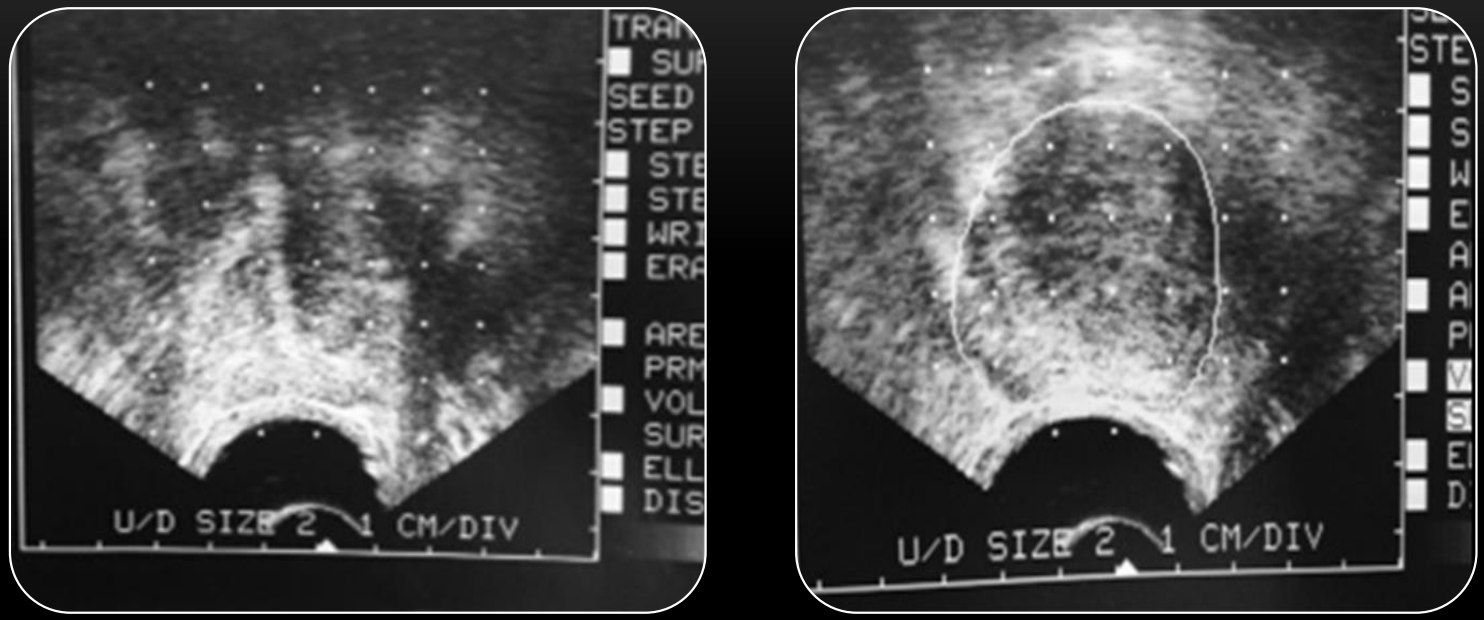
12 I implant to prostate

79 seeds : 22 catheters implanted

v. little bleeding at end of oper:

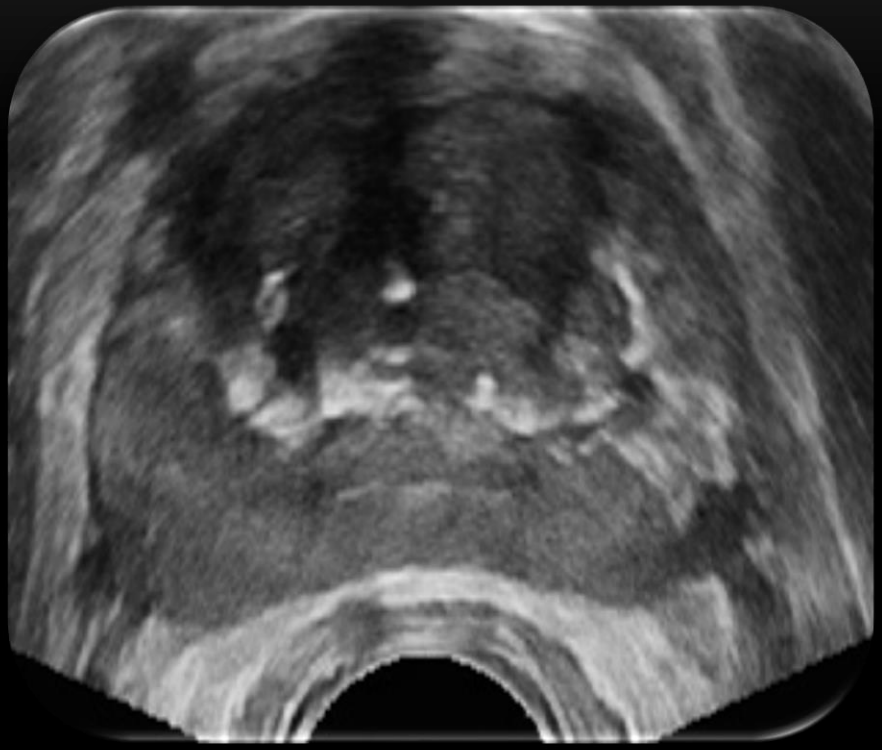
16F catheter left in bladder

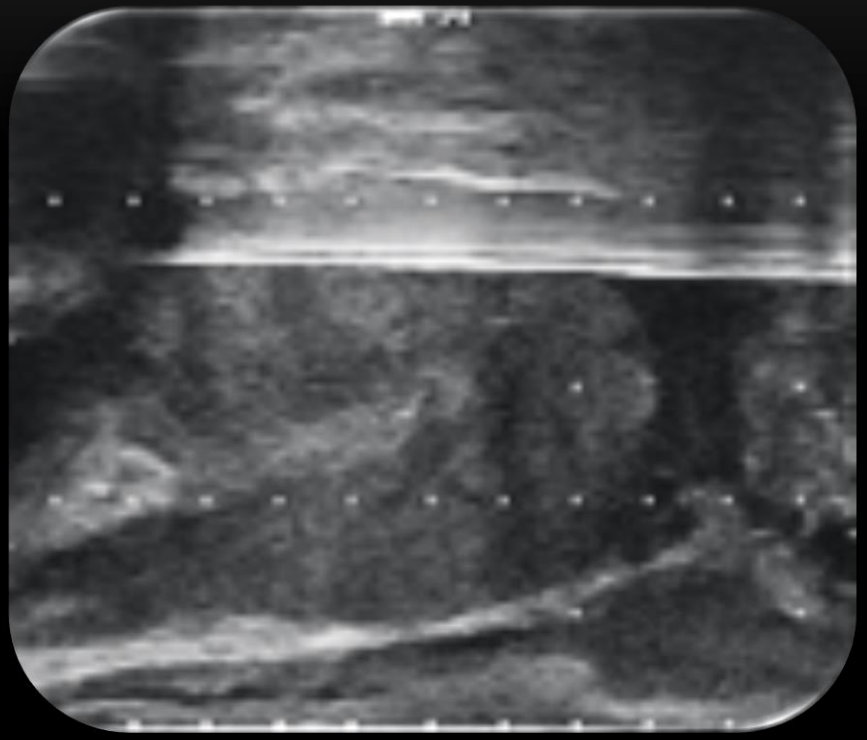
Seeing is (maybe) believing…

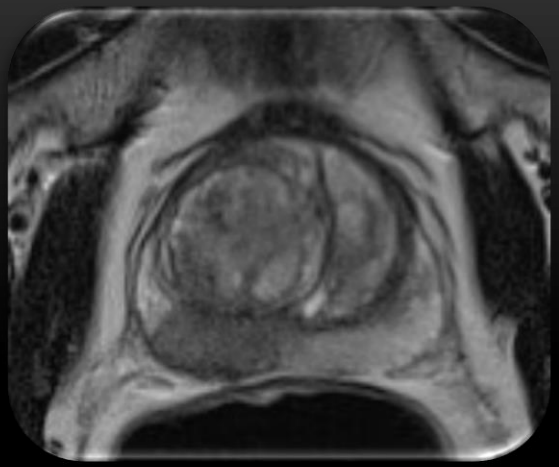


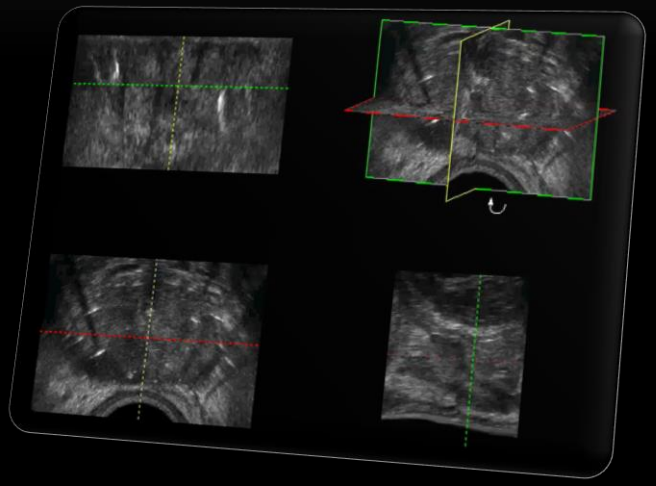
3.5 MHz. Mechanical Probe
(B&K 1840)
Hard Copy scanned into Planning System

Imaging is better 20 years on…










Hard
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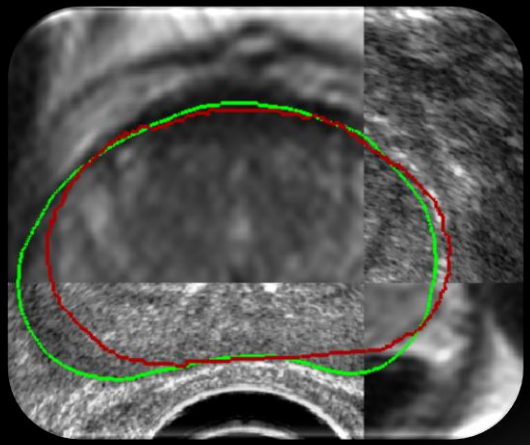
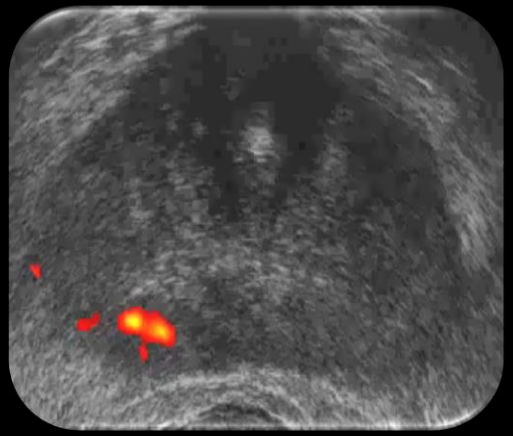
11 70/-/1/3/0/A/5 BL.:26% 2/-/-/2/3/4 T-Elaste





Don’t forget your Anusol..

Plug your Needle with confidence..

Loose / stranded seeds

International Journal of Radiation Oncology*Biology*Physics

Volume 59, Issue 2, 1 June 2004, Pages 397–399

Clinical investigation: prostate

The use of linked seeds eliminates lung embolization following permanent seed implantation for prostate cancer

Bashar Al-Qaisieh, M.Sc.*, Brendan Carey, F.R.C.R.†, Dan Ash, F.R.C.R.†, David Bottomley, F.R.C.R.†

Show more

doi:10.1016/j.ijrobp.2003.10.034

Abstract

Purpose

A number of reports of ^{125}I seed migration to the lungs after prostate brachytherapy have been published. There are, however, very limited data available on how to reduce the risk of this event. The purpose of the present report is to determine whether seed embolization to the lungs can be minimized by using stranded seeds alone for brachytherapy.

Methods and materials

Between December 2001 and December 2002, 238 patients with early prostate cancer were treated with prostate brachytherapy as monotherapy using ^{125}I stranded seeds (RAPIDStrand) exclusively. All patients had fluoroscopy during the implant and immediate postimplant radiographs of the pelvis. A sample of 100 patients had chest radiographs performed, on average, 55 days after implant. To determine the ease, or lack of ease, with which these ^{125}I seeds could be visualized, 4 patients who did not have prostate cancer and who were having routine chest radiographs as part of their management for other cancers consented to have posteroanterior and lateral radiographs performed with inactive ^{125}I seeds taped to the skin of the thorax. All radiographs were reviewed by a single radiologist.

Results

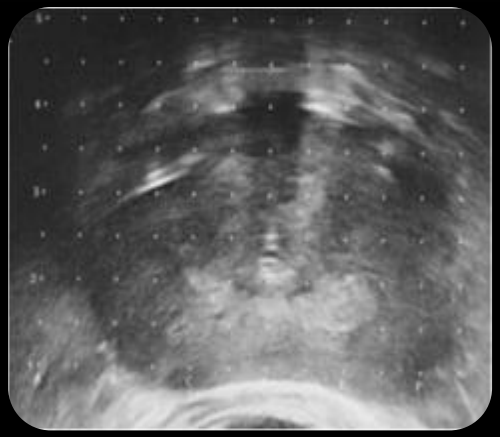
The number of seeds noted on the postimplant radiographs corresponded to the number of implanted seeds in all 238 cases: There was, therefore, no evidence of seed embolization immediately postimplant. On review of the 100 chest radiographs, no embolized seeds were found.

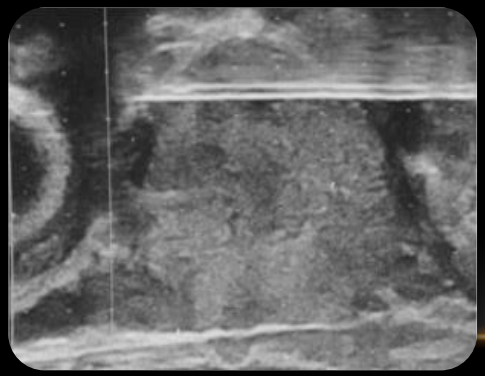
Conclusion

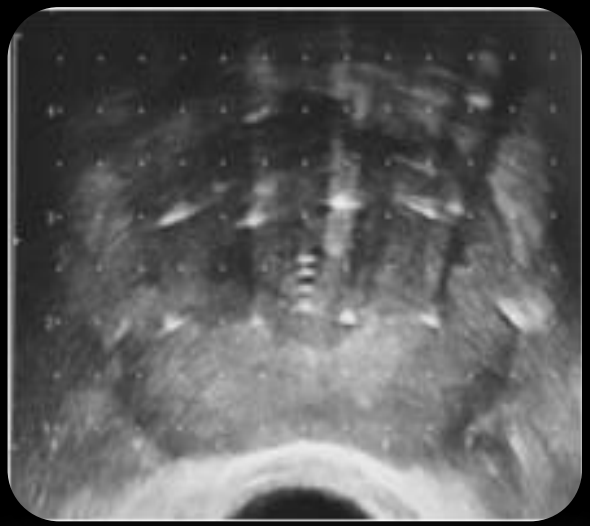
No evidence of seed embolization was observed with the use of stranded ^{125}I seeds as used for prostate brachytherapy.

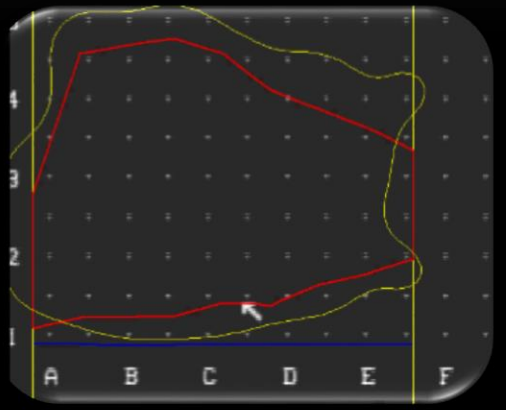
Leeds Technique has evolved over the 20 years…

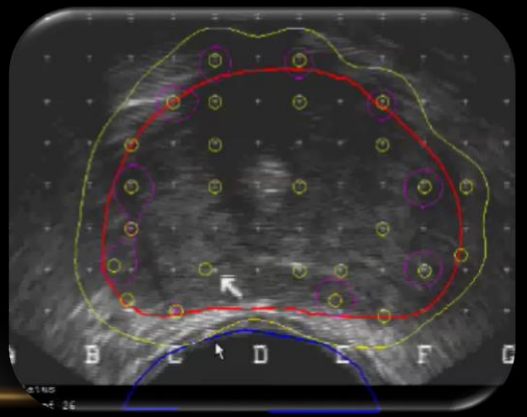
Original Seattle 2-Step → **Single-Step**











We learned about Toxicity…

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Side effects of permanent I125 prostate seed implants in 667 patients treated in Leeds

David Bottomley, Dan Ash, Bashar Al-Qaisieh, Brendan Carey, Joji Joseph, Shaun St Clair, Kathy Gould

Received: April 18, 2006; Received in revised form: October 31, 2006; Accepted: November 14, 2006; Published Online: December 12, 2006

" the side effects and complications confirm that the treatment is not only convenient but also has a low risk of serious long-term side effects"

Radio & Oncol 2007

We looked at Quality of Life.....

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A prospective analysis of long-term quality of life after permanent I-125 brachytherapy for localised prostate cancer

Dan Ash, David Bottomley, Bashar Al-Qaisieh, Brendan Carey, Kath Gould, Ann Henry

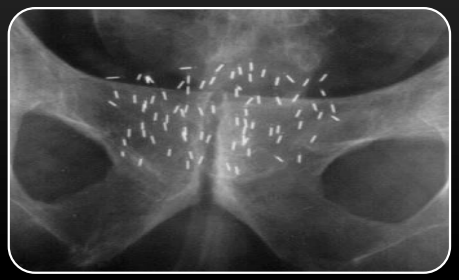
Received: September 27, 2006; Received in revised form: April 18, 2007; Accepted: May 15, 2007; Published Online: July 09, 2007

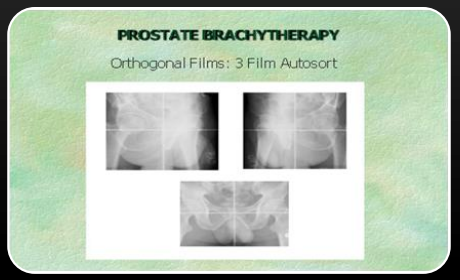
- An initial period of mild to moderate urinary symptoms prostate brachytherapy is well tolerated with relatively little deterioration in long-term quality of life.
- Long-term reduction in sexual function may be seen particularly in those requiring hormones

Radio & Oncol 2007

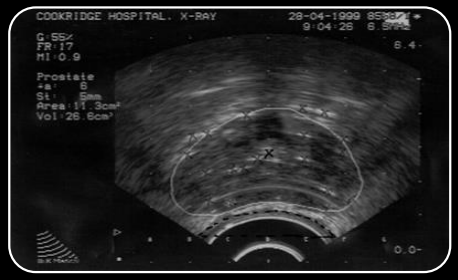
We learned about Post Implant dosimetry

Radiographs…



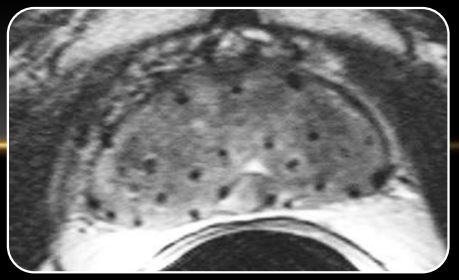


Ultrasound...

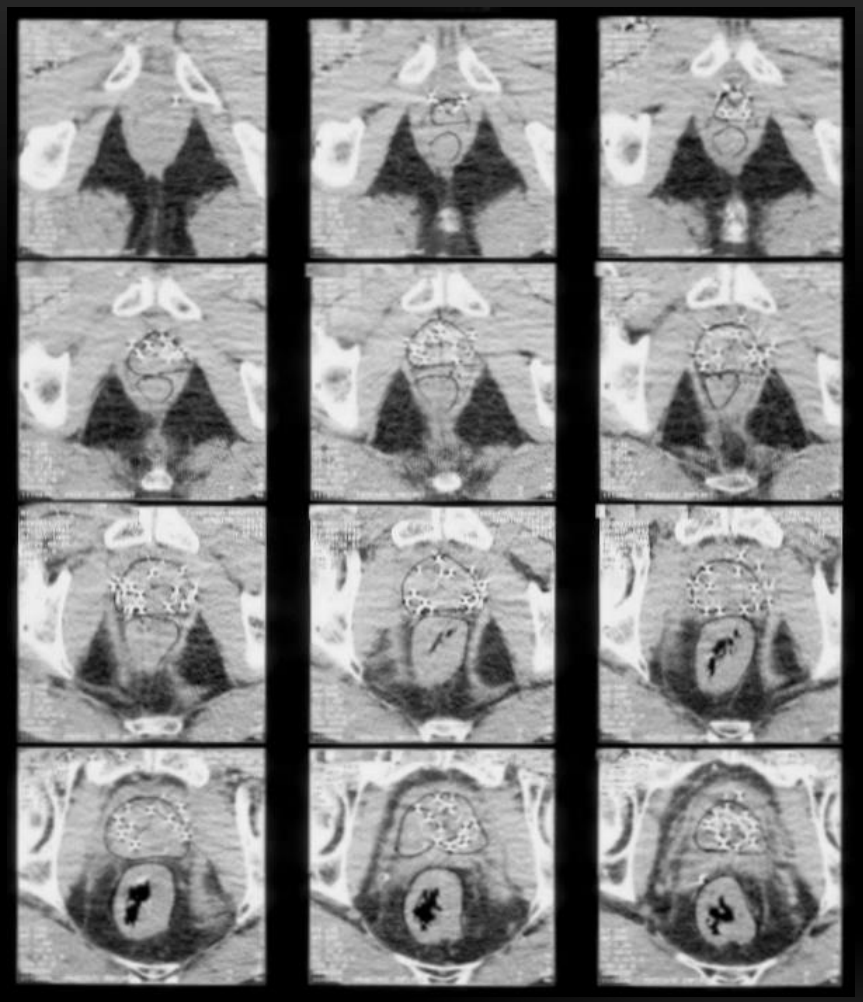


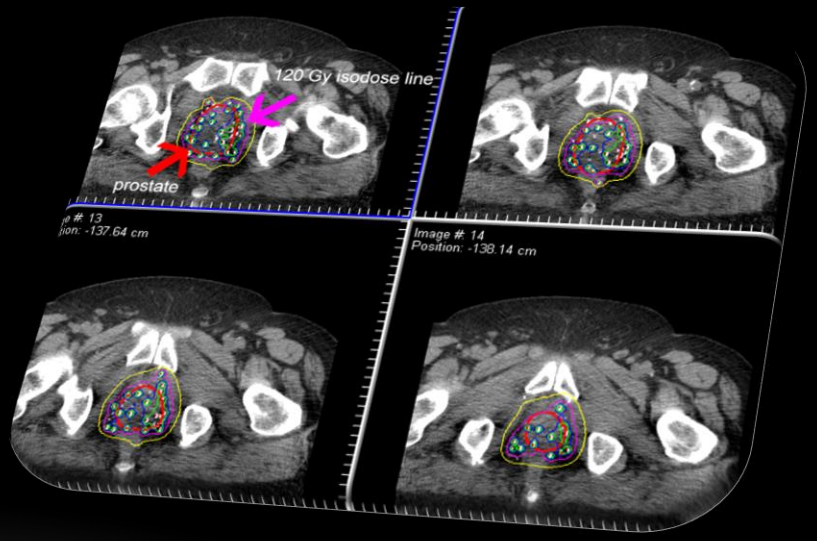
CT…

MRI…

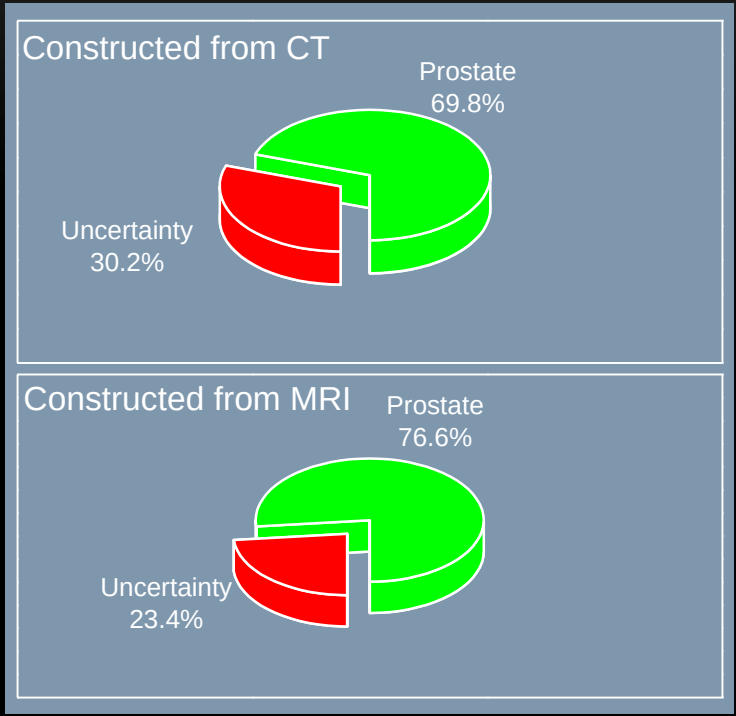


CT…





The “ Art “ of Prostate Brachytherapy…

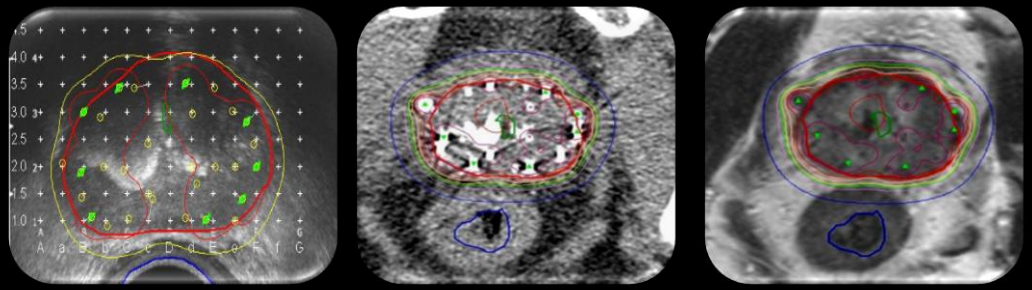


MRI can improve observer accuracy in outlining the prostate compared with CT.

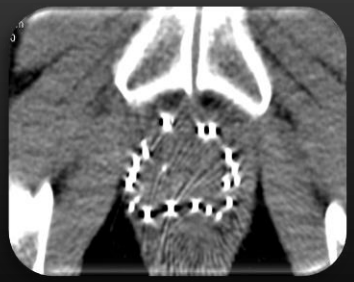
This improvement has no significant effect on the post implant dosimetry quality indices in comparison with CT alone.

MRI, however, is still a valuable tool for ***learning*** about prostate anatomy.

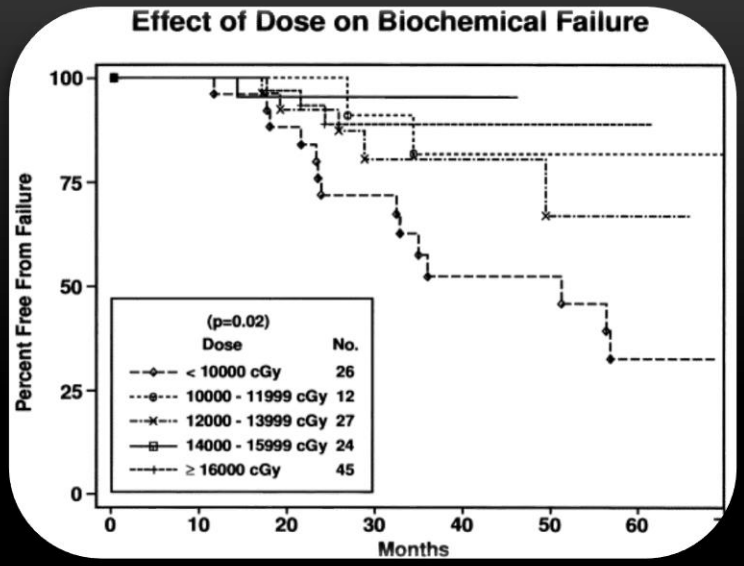
GEC ESTRO 2004

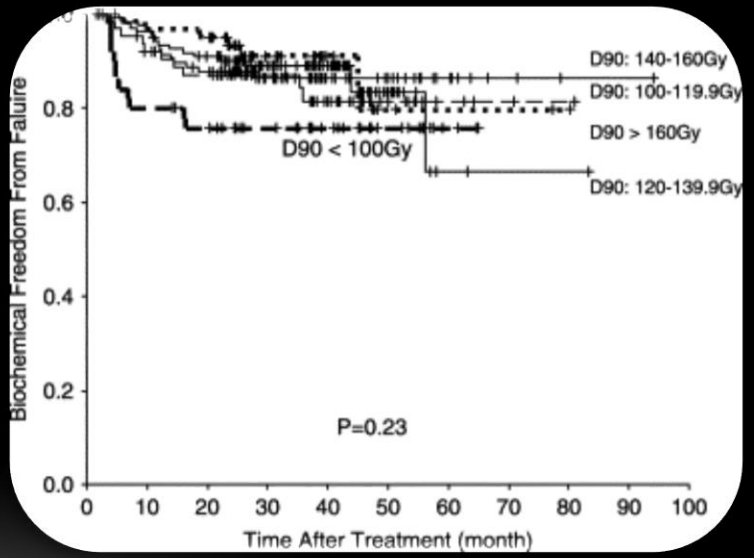


..in defence of CT



- Widely used with consistent results *within* experienced centres
- Gives us some value in evaluating new techniques
- *Has* shown a Dose Response Relationship for prostate brachytherapy that correlates with outcomes.





Ash 2006

We learned about D90..

- **667 patients treated between 1995 and 2001**
- **Post-implant dosimetry was performed on 413 patients**
- **Mean follow-up 4 years (2-8 years)**

- **Correlation between D90 and outcome shows no significant difference for the whole population between those who receive greater or less than 140 Gy (*P*=0.43) and there was also no difference for those receiving more or less than 130 Gy (*P*=0.14).**

- **D90 was found to be a good discriminator for those with low risk where failure to achieve local control is likely to be the dominant cause of PSA failure.**

- ***D90 is a good discriminator only for low risk patients***

Radio & Oncol 2007

We persuaded surgeons not to / be very cautious about biopsy of anterior rectum..

Recto-urethral fistula following brachytherapy for localized prostate cancer

D. Shakespeare[1], D. M. Mitchell[1], B. M. Carey[2], P. Finan[3], A. M. Henry[1], D. Ash[1], D. M. Bottomley[1] and B. Al-Qaisieh[4]

Article first published online: 21 NOV 2006

DOI: 10.1111/j.1463-1318.2006.01119.x

Issue

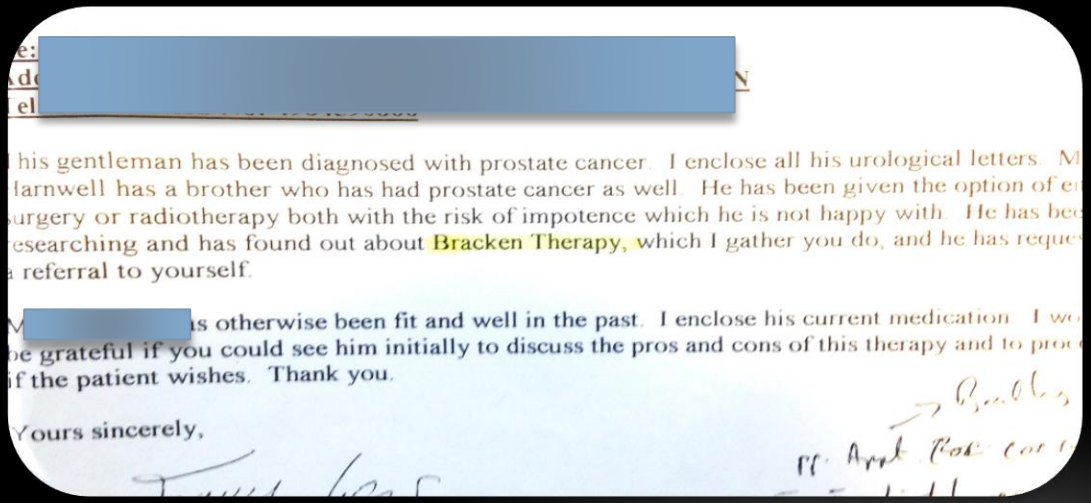
Colorectal Disease

Volume 9, Issue 4, pages 328–331, May 2007

- 3 / 1455 patients (0.2%)
- All 3 had rectal symptoms
- All 3 had surgical endoscopy + anterior rectal wall biopsy

Colorectal Disease 2007

Occasionally misunderstood….



his gentleman has been diagnosed with prostate cancer. I enclose all his urological letters. M
larnwell has a brother who has had prostate cancer as well. He has been given the option of e
urgery or radiotherapy both with the risk of impotence which he is not happy with. He has be
esearching and has found out about Bracken Therapy, which I gather you do, and he has reque
a referral to yourself.

s otherwise been fit and well in the past. I enclose his current medication. I wo
e grateful if you could see him initially to discuss the pros and cons of this therapy and to proc
f the patient wishes. Thank you.

Yours sincerely,

74 Year old patient referred for “bracken therapy “

We learned that Brachytherapy worked ….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16 Experience of prostate brachytherapy in leeds 1995 – 2000

D. Ash, D.M. Bottomley, B. Carey, A. Flynn

DOI: http://dx.doi.org/10.1016/S0167-8140(00)81340-7


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Long-term outcomes and morbidity after I125 brachytherapy for localised prostate cancer: an early UK series

D. Ash, B. Carey, D.M. Bottomley, B. Al-Qaisieh

Cookridge Hospital, Hospital Lane, Cookridge, Leeds, UK


International Journal of Radiation Oncology biology • physics

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Outcomes Following Iodine-125 Monotherapy for Localized Prostate Cancer: The Results of Leeds 10-Year Single-Center Brachytherapy Experience

Ann M. Henry, M.D., Bashar Al-Qaisieh, Ph.D., Kathy Gould, R.G.N., Peter Bownes, M.Sc., Jonathan Smith, F.R.C.R., Brendan Carey, F.R.C.R., David Bottomley, F.R.C.R., Dan Ash, F.R.C.R.

Received: October 20, 2008; Received in revised form: January 21, 2009; Accepted: January 26, 2009;


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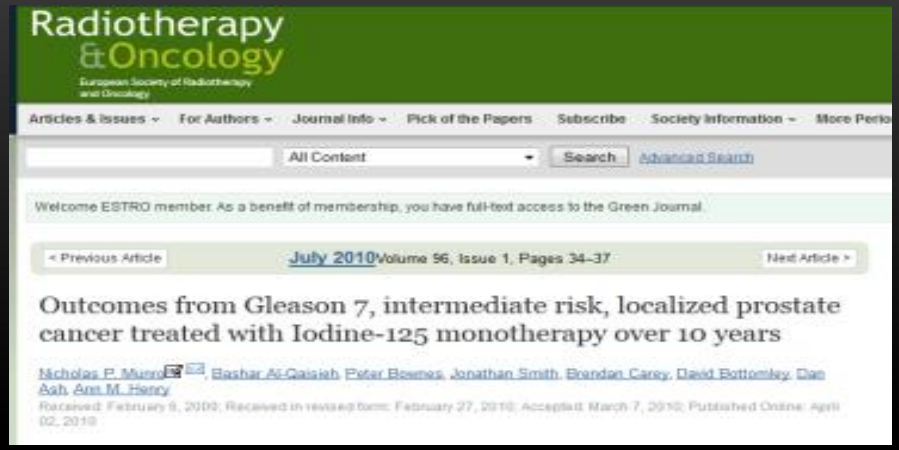
Outcomes from Gleason 7, intermediate risk, localized prostate cancer treated with Iodine-125 monotherapy over 10 years

Nicholas P. Munro, Bashar Al-Qaisieh, Peter Bownes, Jonathan Smith, Brendan Carey, David Bottomley, Dan Ash, Ann M. Henry

Received: February 6, 2009; Received in revised form: February 27, 2010; Accepted: March 7, 2010; Published Online: April 02, 2010



Gleason 3+4 *v* Gleason 4 +3 (PSA < 10 ng/ml)

- 187 patients between 1995 – 2004
- Mean Follow-up 5 years (2 – 10)

G 3+4 : 5 year PSA-RFS = 86 % (ASTRO)
G 4+3 : 5 year PSA-RFS = 82%

- For D90 > 140Gy : 92% 5 year PSA-RFS
- For D90 < 240Gy : 77% 5 year PSA-RFS

Radio & Oncol 2010

International Journal of
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Official Journal of the American Society for Radiation Oncology
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Outcomes Following Iodine-125 Monotherapy for Localized Prostate Cancer: The Results of Leeds 10-Year Single-Center Brachytherapy Experience

Ann M. Henry, M.D., Bashar Al-Qaisieh, Ph.D., Kathy Gould, R.G.N., Peter Bownes, M.Sc., Jonathan Smith, F.R.C.R., Brendan Carey, F.R.C.R., David Bottomley, F.R.C.R., Dan Ash, F.R.C.R.

Received: October 20, 2008; Received in revised form: January 21, 2009; Accepted: January 26, 2009;

1298 patients treated from 1995 -2004

Median follow-up 4.9 years (2-12)

- **D90 ≥ 140Gy : 88% biochemical control**
- **D90 ≤ 140Gy : 78% biochemical control**

Overall PSA-RFS was 79.9% and 72.1% at 10 years

ASTRO and Nadir+2 definitions, respectively ($p < 0.01$).

IJROBP 2010

ARTICLE IN PRESS

Clinical Oncology xxx (2015) 1–5

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Clinical Oncology

journal homepage: www.clinicaloncologyonline.net

Original Article

The Effect of Dose and Quality Assurance in Early Prostate Cancer Treated with Low Dose Rate Brachytherapy as Monotherapy

A.M. Henry *†, S.L. Rodda *, M. Mason *, H. Musurunu *, B. Al-Qaisieh *, P. Bownes *, J. Smith *, K. Franks *, B. Carey *, D. Bottomley *

* Leeds Cancer Centre, St James's University Hospital, Leeds, UK
† University of Leeds, Leeds, UK

Received 29 September 2014; received in revised form 28 January 2015; accepted 5 March 2015

Abstract

Aims: To examine the relationship between post-implant computed tomography dosimetry and long-term prostate-speci c antigen relapse-free survival in patients treated with iodine 125 (I-125) low dose rate prostate brachytherapy as monotherapy and, second, to audit recent practice against Royal College of Radiologists' (RCR) guidelines after the re-introduction of post-implant dosimetry for all patients in our centre.

Materials and methods: Between March 1995 and September 2007, 2157 consecutive patients with localised prostate cancer underwent I-125 permanent prostate brachytherapy as monotherapy in a single UK centre. All patients were transrectal ultrasound planned delivering a 145 Gy (TG 43) minimum peripheral dose. None received supplemental external beam radiotherapy. Post-implant computed tomography-based dosimetry was undertaken between 4 and 6 weeks after treatment and was available for 711 (33%). Outcomes were analysed in terms of the relationship of D90 to prostate-speci c antigen relapse-free survival (nadir 2+ de nition) and all patients had a minimum follow-up of 5 years. For contemporary patients from 2011, quality metrics from post-implant computed tomography as de ned by RCR guidelines are presented.

Results: A mean D90 of 138.7 Gy (standard deviation 24.7) was achieved for the historic cohort. Biochemical control at 10 years was 76% in patients with D90 > 140 Gy and 68% in those with D90 < 140 Gy ($P < 0.01$). In current practice, over the last 3 years the mean (standard deviation) D90 has increased from 154 (15.3) Gy in 2011 to 164 (13.5) Gy in 2013. Similarly, an increase in the mean (standard deviation) V100 from 92 (4.4) to 95 (3.2) % is noted over time. No difference between clinicians was noted.

Conclusion: D90 values of less than 140 Gy continue to be predictive of increased risk of recurrence of prostate cancer across risk groups with longer follow-up. Quality assurance can be used to ensure improved and consistent implant quality in a team with multiple clinicians.

Key words: Brachytherapy; dosimetry; outcomes; prostate cancer; quality assurance

Introduction

Permanent low dose rate (LDR) brachytherapy is a well-established treatment option for early prostate cancer [1], with advantages over other options in terms of improved sexual, bowel and urinary function in the long term [2]. In early prostate cancer, improved prostate-speci c antigen (PSA) control with radiation dose escalation has been shown in randomised trials using external beam radiotherapy [3] and in multi-institutional series of cohorts treated with permanent prostate brachytherapy [4].

In permanent prostate brachytherapy, computed tomography-based post-implant dosimetry is used to quantify D90 (the minimum dose received by 90% of the prostate volume) and V100 (the percentage volume of the prostate receiving at least 100% of the prescribed dose) as measures of both the quality of an individual implant and also quality assurance for the prostate brachytherapy programme. Concerns about training and quality assurance in the USA led the UK and Ireland Prostate Brachytherapy Group in conjunction with the Royal College of Radiologists (RCR) to develop and publish quality assurance practice guidelines in 2012 [5].

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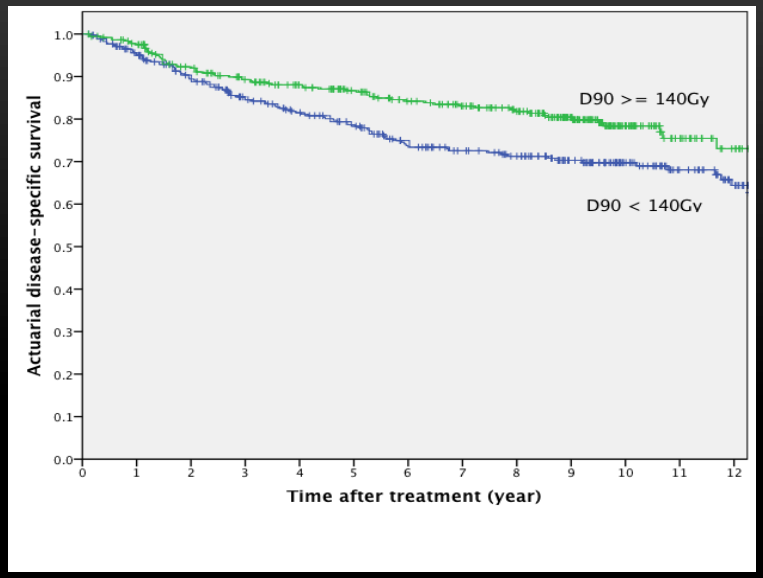
E-mail address: A.Henry@leeds.ac.uk (A.M. Henry).

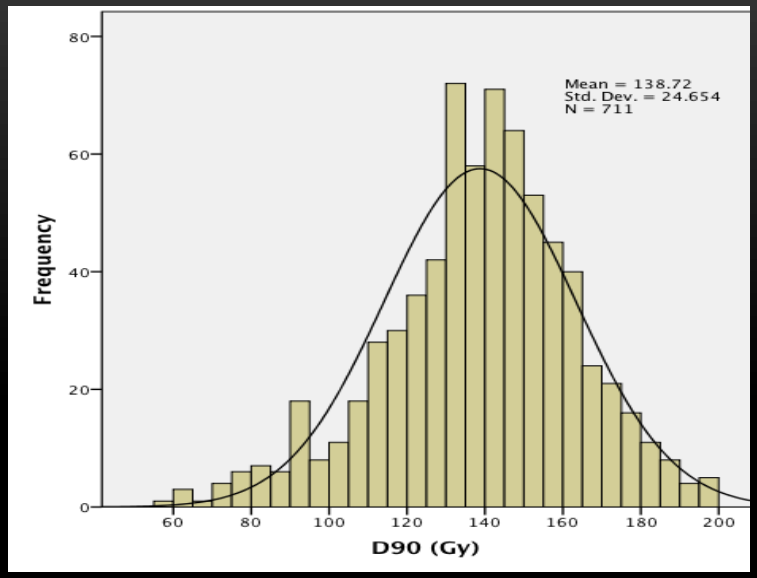
http://dx.doi.org/10.1016/j.clon.2015.03.004
0936-6555/

Please cite this article in press as: Henry AM, et al., The Effect of Dose and Quality Assurance in Early Prostate Cancer Treated with Low Dose Rate Brachytherapy as Monotherapy, Clinical Oncology (2015), http://dx.doi.org/10.1016/j.clon.2015.03.004

- **2157 patients : 1995 - 2007**
- **Patients were stratified using the MSK model**
- **All patients had ^{125}Iodine as monotherapy**
- **Post implant CT based dosimetry was undertaken between 4 to 6 weeks post-implant and was available for 711 (33%)**
- **Outcomes were analysed in terms of relation of D90 to PSA relapse free survival (Nadir 2+) and all patients had a minimum follow up of 5 years.**
- ***Conclusion* : D90 values of less than 140Gy continue to be predictive of increased risk of recurrence across risk groups with longer follow-up**

Clin Onc (in press)

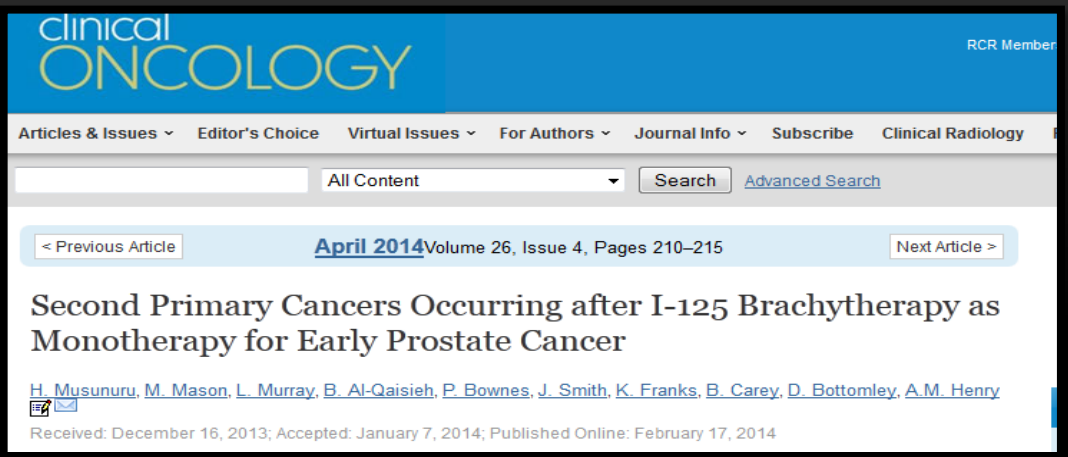




- **Mean D90 of 138.7 (SD 24.7) Gy was achieved for the historic cohort.**
- **Biochemical control at 10 years - 76% in patients with D90 > 140 Gy**
  - 68% in patients with D90 <140 Gy (p <0.01)
- **Over the last 3 years the mean (SD) D90 has increased from 154 (15.3) Gy in 2011 to 164 (13.5) Gy in 2013**
- **The mean (SD) V100 from 92 (4.4) % to 95 (3.2) % was noted over this time**

Clin Onc (in press)

We looked for Second Primary Cancers..



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Second Primary Cancers Occurring after I-125 Brachytherapy as Monotherapy for Early Prostate Cancer

H. Musunuru, M. Mason, L. Murray, B. Al-Qaisieh, P. Bownes, J. Smith, K. Franks, B. Carey, D. Bottomley, A.M. Henry

Received: December 16, 2013; Accepted: January 7, 2014; Published Online: February 17, 2014

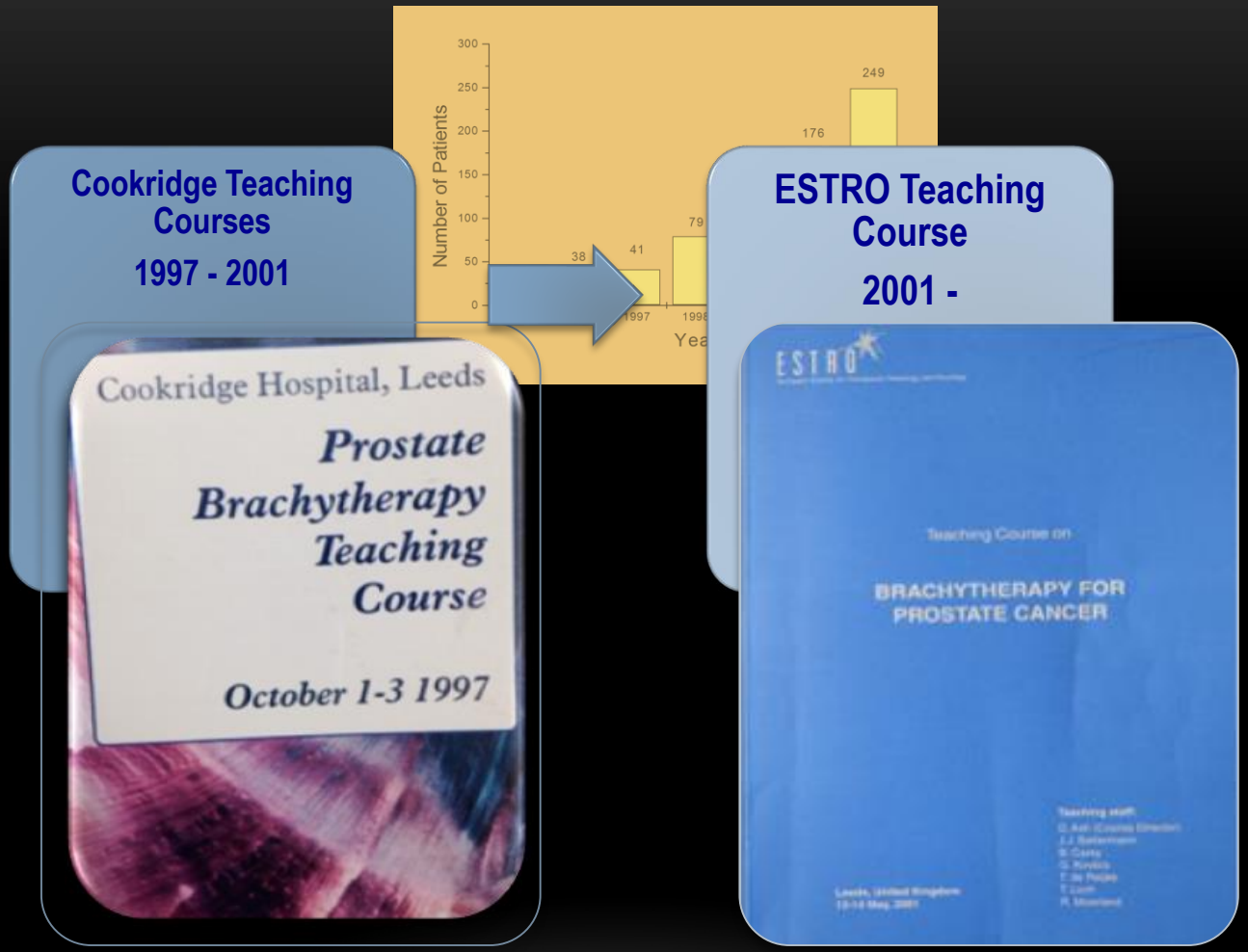
- SPC incidence was retrieved by conducting a UK cancer registry search for 1805 consecutive patients 1995 to 2006 in Leeds

- The incidence of SPC after I-125 is comparable with other published data with no significant excess more than 5 years from treatment

- Mortality secondary to SPC of the bladder or rectum is unusual

Clin Onc 2014

We started Brachytherapy Meetings & Courses..



Paul Evans

1960 - 2010

First UK & Ireland Prostate Brachytherapy Course York 2000

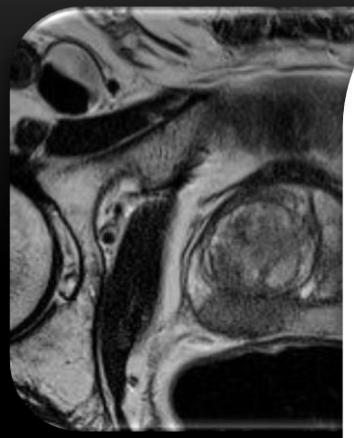
PROSTATE BRACHYTHERAPY

UK & Ireland Conference 2015

ACKNOWLEDGE THE SUPPORT TO LEEDS BY INDUSTRY OVER PAST 20 YEARS

Thanks !

The future…… incorporation of Multiparametric Imaging



IJROBP (in press)

International Journal of Radiation Oncology biology • physics

www.redjournal.org

Physics Contribution

Dosimetry Modeling for Focal Low-Dose-Rate Prostate Brachytherapy

Bashar Al-Qaisieh, PhD,* Josh Mason, MSc,* Peter Bownes, MSc,* Ann Henry, MD,* Louise Dickinson, MD,†,‡ Hashim U. Ahmed, MD,†,§ Mark Emberton, MD,§ and Stephen Langley, MD‖

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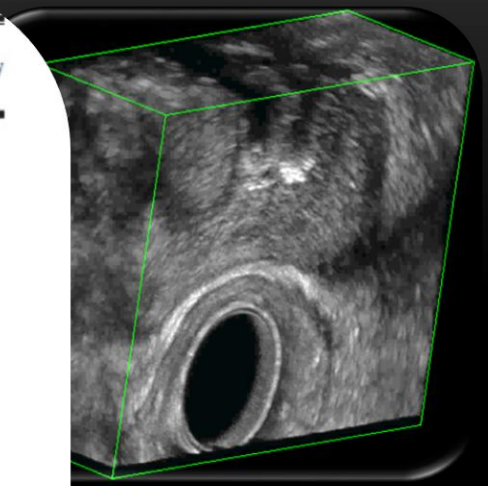
Summary

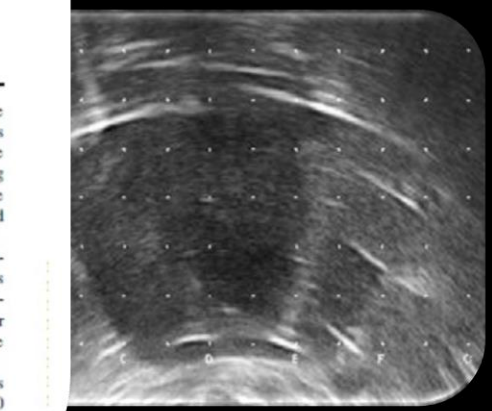
Focal low-dose-rate prostate brachytherapy treatments targeting either a hemi-gland or focal lesion will result in lower doses to organs at risk and may reduce side effects of treatment compared to whole gland therapy. However treating smaller targets makes seed positioning more critical.

Purpose: Focal brachytherapy targeted to an individual lesion(s) within the prostate may reduce side effects experienced with whole-gland brachytherapy. The outcomes of a consensus meeting on focal prostate brachytherapy were used to investigate optimal dosimetry of focal low-dose-rate (LDR) prostate brachytherapy targeted using multiparametric magnetic resonance imaging (mp-MRI) and transperineal template prostate mapping (TPM) biopsy, including the effects of random and systematic seed displacements and interseed attenuation (ISA).

Methods and Materials: Nine patients were selected according to clinical characteristics and concordance of TPM and mp-MRI. Retrospectively, 3 treatment plans were analyzed for each case: whole-gland (WG), hemi-gland (hemi), and ultra-focal (UF) plans, with 145-Gy prescription dose and identical dose constraints for each plan. Plan robustness to seed displacement and ISA were assessed using Monte Carlo simulations.

Results: WG plans used a mean 28 needles and 81 seeds, hemi plans used 17 needles and 56 seeds, and UF plans used 12 needles and 25 seeds. Mean D90 and V100 values were 181.3 Gy and 99.8% for the prostate in WG plans, 195.7 Gy and 97.8% for the hemi-prostate in hemi plans, and 218.3 Gy and 99.8% for the focal target in UF plans. Mean urethra D10 was 205.9 Gy, 191.4 Gy, and 92.4 Gy in WG, hemi, and UF plans, respectively. Mean rectum D2 cm^3 was 107.5 Gy, 77.0 Gy, and 42.7 Gy in WG, hemi, and UF plans, respectively. Focal plans wer



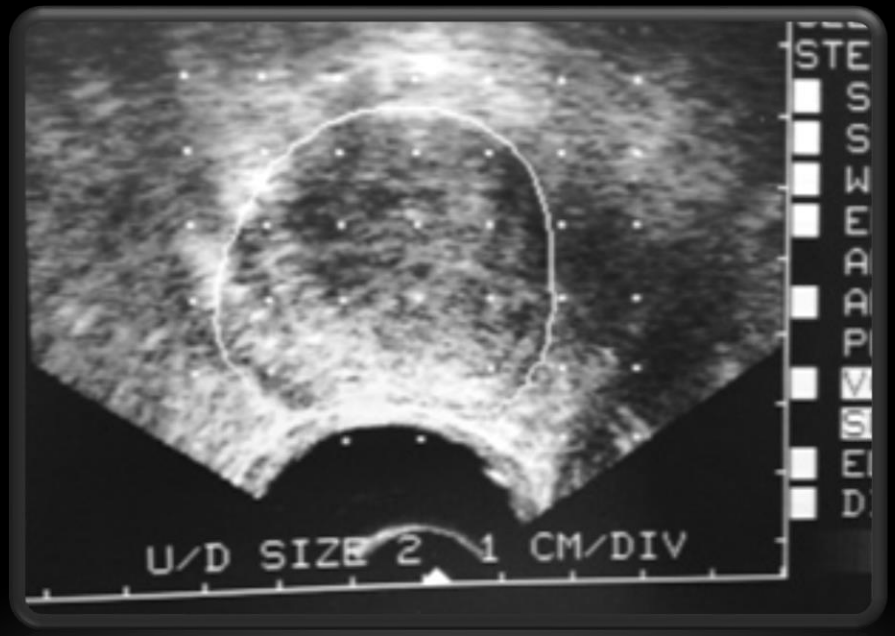


…looks bright !!

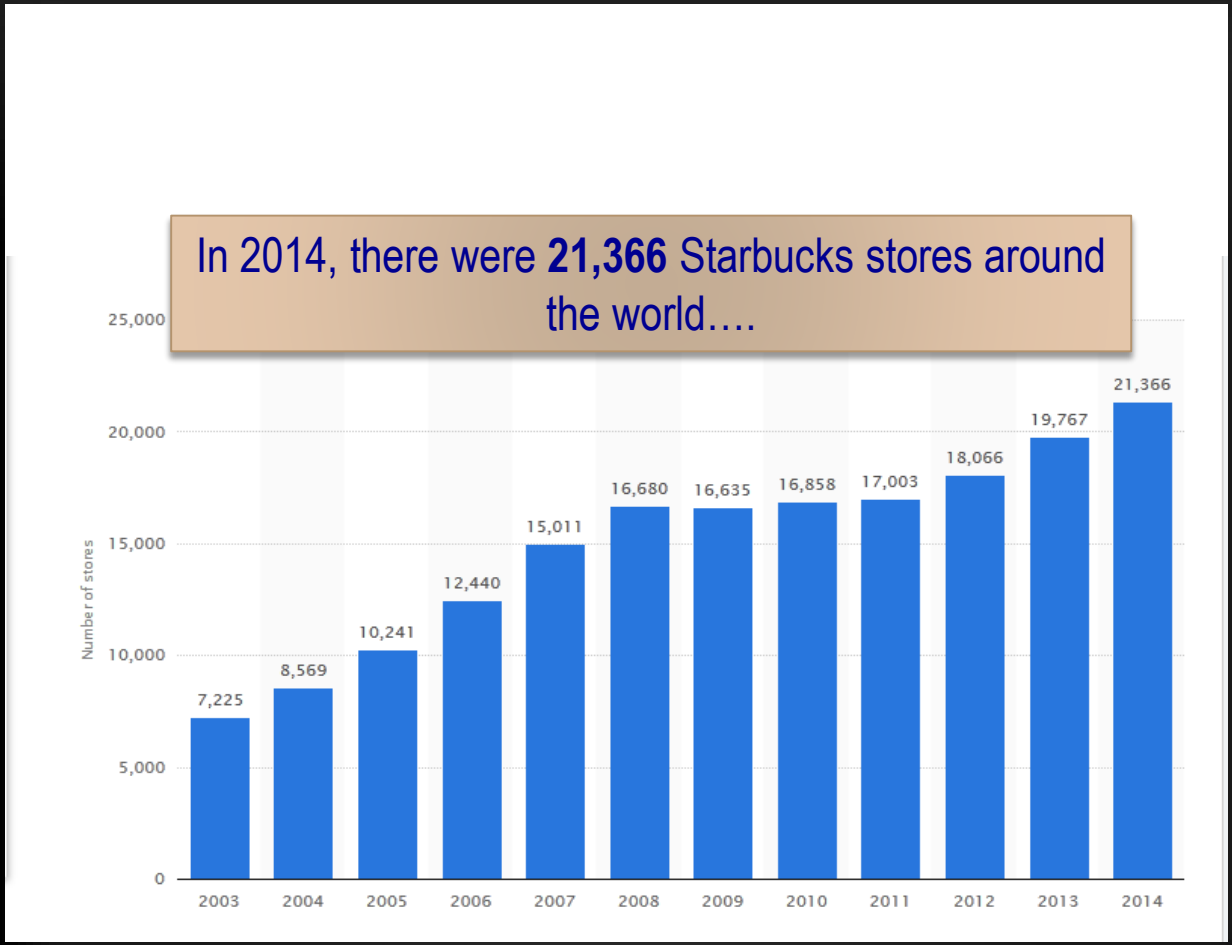
“Number 1”

Now aged 90

PSA 1.7 (Nov. 2014)



And finally……..
Leeds Brachytherapy : 20 years and 3500 implants



(Starbucks not the only successful Seattle export…)

And finally……..
Leeds Brachytherapy : 20 years and 3500 implants