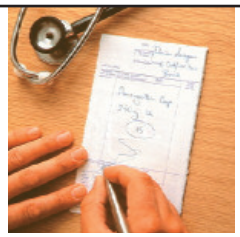

A systematic review of brachytherapy

Is it an effective and safe treatment for localised prostate cancer?

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BACKGROUND

Brachytherapy is a promising treatment for prostate cancer as it may have reduced rates of impotence and incontinence.

OBJECTIVE

General practitioners can influence the treatment patients receive by their referral patterns, so it is important they understand the effectiveness and safety of treatment. We reviewed the primary literature on brachytherapy as sole therapy for localised prostate cancer.

DISCUSSION

Although there have been many studies on the safety and effectiveness of brachytherapy, there have been no trials of brachytherapy versus other treatments that would control for factors such as tumour stage, grade, or initial prostate specific antigen levels. Brachytherapy for localised prostate cancer appears to have equivalent survival rates to surgery and lower rates of impotence and urinary incontinence.

The rate of diagnosis of prostate cancer has risen dramatically in Australia over the past 15 years, partly as a result of increased prostate specific antigen (PSA) testing. General practitioners play a key role in the referral of patients for treatment, and it is therefore important they are aware of the current evidence regarding the possible benefits and harms of the available treatment options.

Permanent brachytherapy is now available on the Medicare Benefits Schedule (MBS) for 'low risk' patients with clinically localised prostate cancer (stage T1, T2a or T2b, a PSA □10 ng/mL and a Gleason score of less than or equal to 6). In the United States, brachytherapy has become the most common form of treatment for localised prostate cancer,[1] primarily due to the apparently lower risk of impotence and incontinence post-treatment. It also avoids the risks of surgery, and treatment can be performed as a day patient procedure with a shorter recovery time.

We reviewed the evidence on the effectiveness and safety of brachytherapy as a treatment for localised prostate cancer. The review was originally undertaken for the Medicare Services Advisory Committee as part of the listing process for the MBS. The full report is available on the MSAC website (http://www.health.gov.au/msac/reports.htm).

Method

The medical literature was searched to identify relevant studies and reviews for the period between January 1990 and June 2002. Searches were conducted of the Cochrane Central Register of Controlled Trials, Medline, EMBASE and CancerLit databases. The search terms used were 'prostate cancer' or 'prostatic neoplasm' [MESH] and 'brachytherapy' or 'iodine implant' or 'prostate implant' or 'brachytherapy' [MESH]. Only articles published since 1990 were considered because of changes in technique at around that time. We only included studies of permanent seed implantation and excluded combination therapy with external beam radiotherapy or studies that included less than 40 patients.

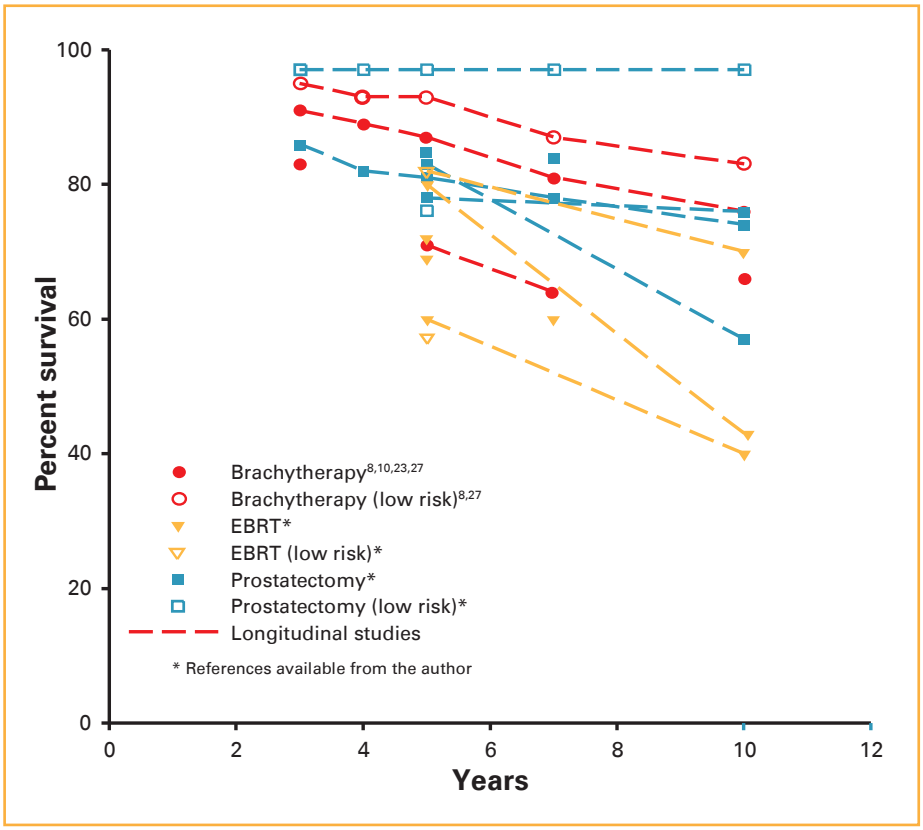

Figure 1. Failure free survival (= no biochemical or clinical evidence of disease)

The abstracts of all citations retrieved by the above searches were scanned and the full text of all studies that appeared to be primary studies obtained. The studies were assessed for quality and the data extracted independently by two reviewers. Any disagreements were resolved by consensus.

Results

Effectiveness

Until recently, there has been no agreement regarding the definition of failure after treatment for prostate cancer. All cause mortality may not accurately reflect the effectiveness of treatment because of the high rate of mortality from other causes in this older population. Common measures used are biochemical failure (indicated by rising PSA levels) or disease free survival (no biochemical or clinical evidence of disease), but the way that these are defined has varied considerably between the studies.

We identified two systematic reviews,[2,3] seven retrospective cohort studies,[4-10] and 22 case series[11-32] that reported survival rates following brachytherapy. Twenty-three studies involved reports on overlapping or duplicate cohorts of patients. There have been no trials comparing brachytherapy with other modalities or against deferred initial treatment. (A trial of prostatectomy versus brachytherapy in low risk men has commenced in the United States and Canada [SPIRIT trial],[2] but will not report for a number of years). The results are shown schematically in *Figure 1*. The effect of potential confounding factors such as age, stage of disease, and pre-treatment PSA levels result in the wide range of results seen in these uncontrolled studies, but they show that survival rates are generally high for all treatment modalities for patients with low risk disease.

The Gleason score

The Gleason score is a method for rating the histological appearance of prostate cancer. It is based on the shape and microscopic appearance of tumours from two sites, eg. 7=4+3. It is recommended that the first reported pattern should be the most common and the second reported pattern the second most common. The highest grade pattern should also be reported, regardless of frequency.

The retrospective cohort study by Brachman et al[7] illustrates the dangers of comparisons between studies without adjusting for confounding factors. This study showed similar rates of survival following brachytherapy and external beam radiotherapy (EBRT) overall, but patients treated with brachytherapy had lower initial PSA and Gleason scores. When the results were analysed by presenting PSA and Gleason score, patients with a presenting PSA >10 or a Gleason score >6 had lower survival rates when treated with brachytherapy than when treated with EBRT. The difference in survival rates between low, intermediate and high risk groups was confirmed by another retrospective cohort analysis.[4] This study found no difference in biochemical progression free survival rates between patients treated with radical prostatectomy, EBRT or brachytherapy for patients defined as low risk (stage T2a, PSA 10 ng/mL and Gleason score 6) but lower survival rates for patients at intermediate or high risk treated with brachytherapy than for those treated with surgery or EBRT. The results of these two studies conflict with a more recent study that showed no difference in survival between men treated with brachytherapy or radical prostatectomy even in intermediate and high risk groups.[9]

Survival rates for all treatment modalities are high for all men and all treatments in the low risk group (>90%). This raises the question, is brachytherapy – as has been suggested previously – an expensive form of 'watchful waiting'?[33] Ideally survival should be compared to that of a group treated with deferred initial treatment and should define the proportion and the characteristics of men who require intervention. About 50% of men on waiting programs come to active treatment within 5 years, so it is the effects of delayed treatment rather than avoidance of

treatment that should be analysed.[34]

Safety

We identified two systematic reviews,[2,3] one randomised controlled trial of iodine versus palladium implants,[35] one prospective cohort study,[36] seven retrospective cohort studies,[32,36-41] and 27 case series[10,33,42-46] that reported on complications following brachytherapy. As with the studies of effectiveness, there were several reports of overlapping and duplicate cohorts of patients. The complication rates reported in the literature are shown schematically in *Figure 2*. Many report complications according to the Radiation Therapy Oncology Group (RTOG) toxicity scales (*Table 1*).

It is difficult to compare populations with varying times of observation since complication rates vary considerably over time. This causes some of the variation seen in *Figure 2*. In the immediate post-treatment period, the most common complication is acute urinary retention, which may require temporary catheterisation. This occurs in about 15% of patients,[47-50] with one study reporting the rate to be as high as 38%.[51] It has been shown that up to 1% of seeds migrate to the lungs as shown on chest X-ray, but there are no known harmful side effects from this.[43,52] Urinary symptoms such as frequency, nocturia and dysuria occur commonly and rise to a peak of about 80% of patients complaining of symptoms 2–3 months after treatment and then declines.[32,45]

Later complications of brachytherapy include urethral stricture, impotence and incontinence. The median time to the development of a stricture has been reported as 18 months[32] and 27 months.[52] Approximately 7% of Medicare patients in the United States who had had brachytherapy treatment required a later TURP for obstruction[39,40] which is consistent with the rate of strictures reported in case series.[10,32,52] The median time to impotency was 14 months.[53] Generally, there have been lower rates of impotence reported after brachytherapy, but this finding is not consistent and a recent study found worse sexual functioning in men treated with brachytherapy than with EBRT or prostatectomy.[38] *Figure 2* shows the wide range of rates of impotency reported from case series. Higher rates of impotence are seen in studies with an older

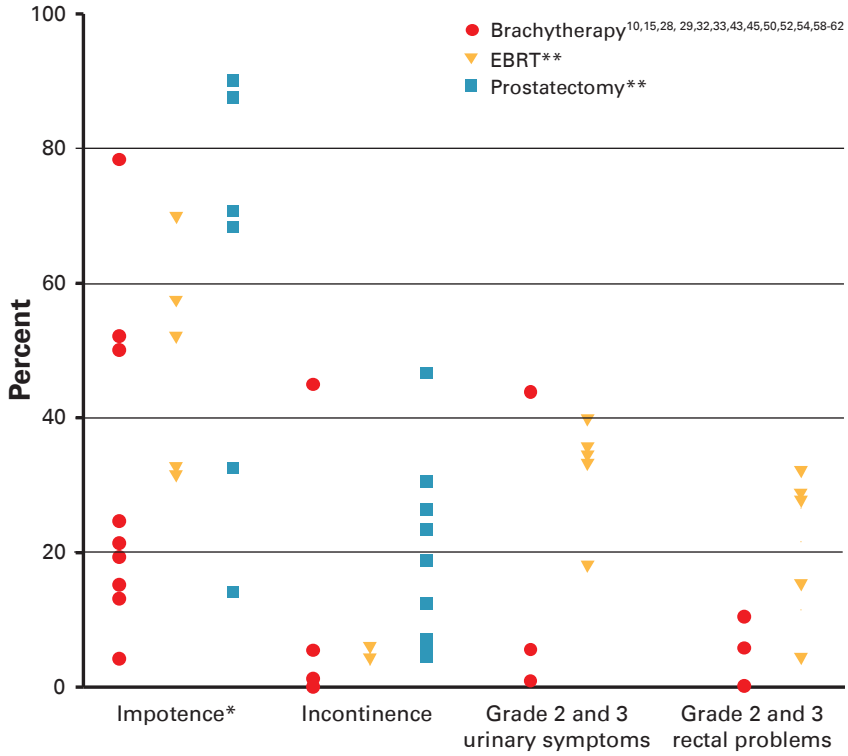

Figure 2. Complications following treatment for clinically localised prostate cancer (measured at 12-24 months post-treatment)

Table 1. Modified RTOG toxicity scales[55,57]

Grade	Urinary symptoms	Rectal symptoms
I	Frequency, nocturia or dysuria	Tenesmus, increased frequency or change in bowel habits, not requiring medication, rectal discomfort not requiring medication
II	Obstructive symptoms requiring temporary catheterisation or not completely controlled by alpha blockers, frequency or nocturia <every hour but >twice pretreatment habit	Intermittent rectal bleeding, erythema of rectal lining on proctoscopy, diarrhoea or pain requiring medication
III	Frequency or nocturia >every hour, gross blood or blood clots, catheterisation for >1 week, minor surgical intervention	Rectal ulceration, diarrhoea requiring parenteral support
IV	Requires major surgical intervention or hospitalisation	Bowel obstruction, fistula formation, blood transfusion required

average age of patients and where self reports from patients were used rather than case records. Incontinence has also been recorded as a complication in several studies, but this has mainly occurred in patients who have had a TURP either prior to or after brachytherapy. A much higher rate was seen, however, in a study using self reporting from patients.[54] Comparisons with EBRT have generally shown fewer grade 2 and grade 3 urinary and rectal symptoms. The presence of complications does not necessarily give a good indication of how severely men's lives are disrupted by these problems. A survey of men treated for clinically localised prostate cancer as part of the Health Professional Study found that men treated with brachytherapy had better sexual function and bother scores and urinary function scores but worse urinary bother, bowel function and bowel bother scores than men treated with prostatectomy.[41]

Discussion

The decision facing a man recently diagnosed with clinically localised prostate cancer is one of the most difficult in medicine. The decision is subject to a trade-off between the possible survival advantage of treatment against the quality of life issues that are associated with treatment, and yet we have few high quality studies to determine the harms and benefits with any certainty. General practitioners need to be able to assist men with this choice, including the choice of referral options.

Radical prostatectomy is the most established treatment for localised prostate cancer in Australia, but there is still only limited high level evidence regarding its effectiveness. A recent Scandinavian trial of radical prostatectomy versus 'watchful waiting' showed that surgery reduced disease specific mortality but not overall mortality.[55] A trial is also underway in the United States to assess the effectiveness of radical prostatectomy versus initial observation for clinically localised prostate cancer (PIVOT trial), but the results of this trial will not be available for several years.[56]

Based on the available data, the incidence of complications appears to be similar for the three main treatment options. Brachytherapy may have some advantage in terms of potency preservation and preservation of urinary continence but has a higher incidence of obstructive urinary symptoms and irritative urinary symptoms, at least in the short term. In terms of treatment modality, brachytherapy as sole treatment is really only applicable to patients with disease that is truly likely to be organ confined (see the MSAC criteria), as occult spread beyond the gland would not be effectively treated. For this group of patients, given that the evidence suggests similar outcomes for the different modalities, patients may be advised to make their decision based on the side effect profiles of the treatments.

General practitioners need to ensure that their patients are getting the best advice available so that patients can make an informed decision regarding treatment.

One resource that may be of assistance is the Prostate Cancer Consumer Guide produced by the Australian Cancer Network and available from the Cancer Council in each state.

Summary of important points

- Brachytherapy appears to be as effective as prostatectomy for men with 'low risk' localised prostate cancer, but there have been no studies to demonstrate whether it has better survival rates than 'watchful waiting'.
- Brachytherapy generally results in lower rates of impotence and incontinence than surgery or EBRT but higher rates of obstructive and irritative urinary symptoms.
- Permanent brachytherapy is available on the MBS for 'low risk' patients with clinically localised prostate cancer (stage T1, T2a or T2b, a PSA □10 ng/mL and a Gleason score □6).

References

1. King CR, DiPetrillo TA, Wazer DE. Optimal radiotherapy for prostate cancer: predictions for conventional external beam, IMRT, and brachytherapy from radiobiologic models. Int J Radiat Oncol Biol Phys 2000;46:165–172.
2. Crook J, Lukka H, Klotz L, Bestic N, Johnston M. Systematic overview of the evidence for brachytherapy in clinically localised prostate cancer. CMAJ 2001;164:975–981.
3. Wills F, Hailey D. Brachytherapy for prostate cancer. In: The Alberta Heritage Foundation for Medical Research. Alberta: 1999.
4. D'Amico AV, Whittington R, Malkowicz SB, et al. Biochemical outcome after radical prostatectomy, external beam radiation therapy, or interstitial radiation therapy for clinically localised prostate cancer. JAMA 1998;280:969–974.
5. King C, Sanzone J, Anderson K, Schel R. Definitive therapy for stage T1/T2 prostate carcinoma: PSA based comparison between surgery, external beam, and implant radiotherapy. Journal of Brachytherapy International 1998;14:169–177.
6. Stokes SH. Comparison of biochemical disease free survival of patients with localised carcinoma of the prostate undergoing radical prostatectomy, transperineal ultrasound guided radioactive seed implantation, or definitive external beam irradiation. Int J Radiat Oncol Biol Phys 2000;47:129–136.
7. Brachman DG, Thomas T, Hilbe J, Beyer DC. Failure free survival following brachytherapy alone or external beam irradiation alone for T1–2 prostate tumours in 2222 patients: results from a single practice. Int J Radiat Oncol Biol Phys 2000;48:111–117.
8. Beyer DC, Brachman DG. Failure free survival following brachytherapy alone for prostate cancer: comparison with external beam radiotherapy. Radiother Oncol 2000;57:263–267.
9. Sharkey J, Cantor A, Solc Z, et al. Brachytherapy versus radical prostatectomy in patients with clinically localised prostate cancer. Curr Urol Rep 2002;3:250–257.
10. Zelefsky MJ, Wallner KE, Ling CC, et al. Comparison of the 5 year outcome and morbidity of three dimensional conformal radiotherapy versus transperineal permanent iodine-125 implantation for early stage prostatic cancer. J Clin Oncol 1999;17:517–522.
11. Grado GL, Larson TR, Balch CS, et al. Actuarial disease free survival after prostate cancer brachytherapy using interactive techniques with biplane ultrasound and fluoroscopic guidance. Int J Radiat Oncol Biol Phys 1998;42:289–298.
12. Kwok Y, DiBiase SJ, Amin PP, Naslund M, Sklar G, Jacobs SC. Risk group stratification in patients undergoing permanent 125I prostate brachytherapy as monotherapy. Int J Radiat Oncol Biol Phys 2002;53:588–594.
13. Storey MR, Landgren RC, Cottone JL, et al.

Transperineal 125iodine implantation for treatment of clinically localised prostate cancer: 5 year tumour control and morbidity. Int J Radiat Oncol Biol Phys 1999;43:565–570.
14. Blasko JC, Wallner K, Grimm PD, Ragde H. Prostate specific antigen based disease control following ultrasound guided 125iodine implantation for stage T1/T2 prostatic carcinoma. J Urol 1995;154:1096–1099.
15. Blasko JC, Grimm PD, Sylvester JE, Badiozamani KR, Hoak D, Cavanagh W. Palladium–103 brachytherapy for prostate carcinoma. Int J Radiat Oncol Biol Phys 2000;46:839–850.
16. Grimm PD, Blasko JC, Sylvester JE, Meier RM, Cavanagh W. 10 year biochemical (prostate specific antigen) control of prostate cancer with (125)I brachytherapy. Int J Radiat Oncol Biol Phys 2001;51:31–40.
17. Prestidge BR, Hoak DC, Grimm PD, Ragde H, Cavanagh W, Blasko JC. Post–treatment biopsy results following interstitial brachytherapy in early stage prostate cancer. Int J Radiat Oncol Biol Phys 1997;37:31–39.
18. Ragde H, Blasko JC, Grimm PD, et al. Interstitial iodine–125 radiation without adjuvant therapy in the treatment of clinically localised prostate carcinoma. Cancer 1997;80:442–453.
19. Ragde H, Blasko JC, Grimm PD, et al. Brachytherapy for clinically localised prostate cancer: results at 7 and 8 year follow up. Semin Surg Oncol 1997;13:438–443.
20. Ragde H, Elgamal AA, Snow PB, et al. Ten year disease free survival after transperineal sonography guided iodine–125 brachytherapy with or without 45–gray external beam irradiation in the treatment of patients with clinically localised, low to high Gleason grade prostate carcinoma. Cancer 1998;83:989–1001.
21. Ragde H, Korb L. Brachytherapy for clinically localised prostate cancer. Semin Surg Oncol 2000a;18:45–51.
22. Ragde H, Grado GL, Nadir B, Elgamal AA. Modern prostate brachytherapy. CA Cancer J Clin 2000b;50:380–93.
23. Ragde H, Korb LJ, Elgamal AA, Grado GL, Nadir BS. Modern prostate brachytherapy. Prostate specific antigen results in 219 patients with up to 12 years of observed follow up. Cancer 2000;89:135–141.
24. Ragde H, Grado GL, Nadir BS. Brachytherapy for clinically localised prostate cancer: thirteen year disease free survival of 769 consecutive prostate cancer patients treated with permanent implants alone. Arch Esp Urol 2001;54:739–747.
25. Sharkey J, Chovnick SD, Behar RJ, et al. Minimally invasive treatment for localised adenocarcinoma of the prostate: review of 1048 patients treated with ultrasound guided palladium–103 brachytherapy. J Endourol 2000;14:343–350.
26. Sharkey J, Chovnick SD, Behar RJ, et al. Evolution of techniques for ultrasound guided palladium 103 brachytherapy in 950 patients with prostate cancer. Tech Urol 2000;6:128–134.
27. Stock RG, Stone NN, DeWyngaert JK, Lavagnini P, Unger PD. Prostate specific antigen findings and biopsy results following interactive ultrasound guided transperineal brachytherapy for early stage prostate carcinoma. Cancer 1996;77:2386–2392.
28. Stone NN, Stock RG, Unger P, Kao J. Biopsy results after real time ultrasound guided transperineal implants for stage T1–T2 prostate cancer. J Endourol 2000;14:375–380.
29. Potters L, Cha C, Oshinsky G, Venkatraman E, Zelefsky M, Leibel S. Risk profiles to predict PSA relapse free survival for patients undergoing permanent prostate brachytherapy. Cancer J Sci Am 1999;5:301–306.
30. Potters L. Permanent prostate brachytherapy: lessons learned, lessons to learn. Oncology 2000;14:981–991, 991–992, 997–999.
31. Wallner K, Roy J, Zelefsky M, Fuks Z, Harrison L. Short term freedom from disease progression after I–125 prostate implantation. Int J Radiat Oncol Biol Phys 1994;30:405–409.
32. Zelefsky MJ, Hollister T, Raben A, Matthews S, Wallner KE. Five year biochemical outcome and toxicity with transperineal CT planned permanent I–125 prostate implantation for patients with localised prostate cancer. Int J Radiat Oncol Biol Phys 2000;47:1261–1266.
33. Walther PJ. Interstitial brachytherapy for prostate cancer: just an expensive variant of 'watchful waiting'? Curr Opin Urol 1999;9:201–204.
34. Zietman AL, Thakral H, Wilson L, Schellhammer P. Conservative management of prostate cancer in the prostate specific antigen era: the incidence and time course of subsequent therapy. J Urol 2001;166:1702–1706.
35. Wallner K, Merrick G, True L, Cavanagh W, Simpson C, Butler W. I–125 versus Pd–103 for low risk prostate cancer: morbidity outcomes from a prospective randomised multicenter trial. Cancer J 2002;8:67–73.
36. Lee WR, Hall MC, McQuellon RP, Case LD, McCullough DL. A prospective quality of life study in men with clinically localised prostate carcinoma treated with radical prostatectomy, external beam radiotherapy, or interstitial brachytherapy. Int J Radiat Oncol Biol Phys 2001;51:614–623.
37. Davis JW, Kuban DA, Lynch DF, Schellhammer PF. Quality of life after treatment for localised prostate cancer: differences based on treatment modality. J Urol 2001;166:947–952.
38. Wei JT, Dunn RL, Sandler HM, et al. Comprehensive comparison of health related quality of life after contemporary therapies for localised prostate cancer. J Clin Oncol 2002;20:557–566.
39. Benoit RM, Naslund MJ, Cohen JK. Complications after prostate brachytherapy in the Medicare population. Urology 2000;55:91–96.
40. Benoit RM, Naslund MJ, Cohen JK. A comparison of complications between ultrasound guided prostate brachytherapy and open prostate brachytherapy. Int J Radiat Oncol Biol Phys 2000;47:909–913.
41. Bacon CG, Giovannucci E, Testa M, Kawachi I. The impact of cancer treatment on quality of life outcomes for patients with localised prostate cancer. J Urol 2001;166:1804–1810.
42. Krupski T, Petroni GR, Bissonette EA, Theodorescu D. Quality of life comparison of radical prostatectomy and interstitial brachytherapy in the treatment of clinically localised prostate cancer. Urology 2000;55:736–742.
43. Ankem MK, DeCarvalho VS, Harangozo AM, et al. Implications of radioactive seed migration to the lungs after prostate brachytherapy. Urology 2002;59:555–559.
44. Arterbery VE, Frazier A, Dalmia P, Siefer J, Lutz M, Porter A. Quality of life after permanent prostate implant. Semin Surg Oncol 1997;13:461–464.
45. Blatt HJ, Abel LJ, Stipetich RL, et al. Utilisation of a self administered questionnaire to assess rectal function following prostate brachytherapy. Urol Nurs 2001;21:356–359.
46. Brown D, Colonias A, Miller R, et al. Urinary morbidity with a modified peripheral loading technique of transperineal (125)I prostate implantation. Int J Radiat Oncol Biol Phys 2000;47:353–360.
47. Bucci J, Morris WJ, Keyes M, Spadinger I, Sidhu S, Moravan V. Predictive factors of urinary retention following prostate brachytherapy. Int J Radiat Oncol Biol Phys 2002;53:91–98.
48. Crook J, McLean M, Catton C, Yeung I, Tsihlias J, Pintilie M. Factors influencing risk of acute urinary retention after TRUS guided permanent prostate seed implantation. Int J Radiat Oncol Biol Phys 2002;52:453–460.
49. Ellis RJ, Sodee DB, Spirnak JP, et al. Feasibility and acute toxicities of radioimmunoguided prostate brachytherapy. Int J Radiat Oncol Biol Phys 2000;48:683–687.
50. Thomas MD, Cormack R, Tempany CM, et al. Identifying the predictors of acute urinary retention following magnetic resonance guided prostate brachytherapy. Int J Radiat Oncol Biol Phys 2000;47:905–908.
51. Han BH, Demel KC, Wallner K, Ellis W, Young L, Russell K. Patient reported complications after prostate brachytherapy. J Urol 2001;166:953–957.
52. Older RA, Synder B, Krupski TL, Glembocki DJ, Gillenwater JY. Radioactive implant migration in patients treated for localised prostate cancer with interstitial brachytherapy. J Urol 2001;165:1590–1592.
53. Potters L, Torre T, Fearn PA, Leibel SA, Kattan MW. Potency after permanent prostate brachytherapy for localised prostate cancer. Int J Radiat Oncol Biol Phys 2001;50:1235–1242.
54. Talcott JA, Clark JA, Stark PC, Mitchell SP. Long term treatment related complications of brachytherapy for early prostate cancer: a survey of patients previously treated. J Urol 2001;166:494–499.

55. Holmberg L, Bill-Axelson A, Helgesen F et al. A randomised trial comparing radical prostatectomy with watchful waiting in early prostate cancer. N Engl J Med 2002;347:781-789.
56. Moon TD, Brawer MK, Wilt TJ. Prostate Intervention Versus Observation Trial (PIVOT): a randomised trial comparing radical prostatectomy with palliative expectant management for treatment of clinically localised prostate cancer. PIVOT Planning Committee. J Natl Cancer Inst Monogr 1995;19:69-71.
57. Krumholtz JS, Michalski JM, Sundaram CP. Health related quality of life and morbidity in patients receiving brachytherapy for clinically localised prostate cancer. J Endourol 2000;14:371-374.
58. Desai J, Stock RG, Stone NN, Iannuzzi C, DeWyngaert JK. Acute urinary morbidity following I-125 interstitial implantation of the prostate gland. Radiat Oncol Investig 1998;6:135-141.
59. Sanchez-Ortiz RF, Broderick GA, Rovner ES, Wein AJ, Whittington R, Malkowicz SB. Erectile function and quality of life after interstitial radiation therapy for prostate cancer. Int J Impot Res 2000;12(Suppl 3):S18-S24.
60. Koutrouvelis PG. Three dimensional stereotactic posterior ischiorectal space computerised tomography guided brachytherapy of prostate cancer: a preliminary report. J Urol 1998;159:142-145.
61. Blasko JC, Grimm PD, Ragde H. Brachytherapy and Organ Preservation in the Management of Carcinoma of the Prostate. Semin Radiat Oncol 1993;3:240-249.
62. Gelblum DY, Potters L. Rectal complications associated with transperineal interstitial brachytherapy for prostate cancer. Int J Radiat Oncol Biol Phys 2000;48:119-124.

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Conflict of interest: none declared.

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