



## Case Report:

# Early channel transurethral resection of the prostate for patients with urinary retention after brachytherapy

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**Abstract:** Objective: It is recommended that transurethral resection of the prostate (TURP) after brachytherapy should not be performed at an early stage after implantation. Herein we report our experiences and the results of channel TURP (cTURP) within six months post-implant for patients with refractory urinary retention. Methods: One hundred and ninety patients with localized prostate cancer of clinical stages T1c to T2c were treated by brachytherapy as monotherapy at our institution from February 2009 to July 2013. Nine patients who developed refractory urinary retention and underwent cTURP within six months after brachytherapy were retrospectively reviewed and analyzed. Results: The median interval between prostate brachytherapy and cTURP was three months (range 1.5 to 5.0 months). There were no intraoperative or postoperative complications and no incontinence resulting from the surgery. All urinary retention was relieved per the American Brachytherapy Society urinary symptom score. With a mean follow-up time of 16 months (range 6 to 26 months) after cTURP, no patient experienced biochemical recurrence. The mean serum prostate-specific antigen (PSA) of the patients who underwent cTURP was 0.42 ng/ml (range 0.08 to 0.83 ng/ml) at the end of their follow-up. Conclusions: Early cTURP was found to be safe and effective in relieving urinary retention after brachytherapy and could be performed without compromising its therapeutic efficacy.

**Key words:** Prostate cancer, Brachytherapy, Transurethral resection of the prostate (TURP)

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## 1 Introduction

Brachytherapy is an alternative to radical prostatectomy and external radiation therapy for the treatment of localized prostate cancer. Brachytherapy has become an accepted treatment option for prostate cancer, especially in older patients (Whitmore *et al.*, 2002; Cooperberg *et al.*, 2004). Urinary retention is one of the common complications following brachytherapy. It has been reported to occur in 1.5% to 22.0% of patients (Wallner *et al.*, 1995; Storey *et al.*,

1999; Flam *et al.*, 2000). Transurethral resection of the prostate (TURP) is usually the treatment of choice for patients with refractory urinary retention after implantation. However, it is recommended that TURP should not be done within six months after brachytherapy (Flam *et al.*, 2004). Channel TURP (cTURP) is defined as a procedure removing a minimal amount of prostatic tissue to enlarge the bladder neck and create a voiding channel. This technique is often used for patients with prostatic cancer and urinary retention. Early cTURP for patients with urinary retention after brachytherapy has rarely been reported. We performed cTURP on nine patients with refractory urinary retention within six months after brachytherapy. Their outcomes were reviewed and analyzed.

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## 2 Case reports

From February 2009 to July 2013, 190 patients with localized prostate cancer of clinical stages T1c to T2c underwent brachytherapy as monotherapy at Sir Run Run Shaw Hospital in Hangzhou, China. Twelve patients who developed refractory urinary retention after therapy were treated with cTURP. Nine of these patients had cTURP done within six months after brachytherapy and formed the basis for this study. Their mean Gleason score was 7 (range 6 to 8) and mean serum prostate-specific antigen (PSA) was 15.3 ng/ml (range 5.9 to 25.61 ng/ml) prior to implant. Patients' mean age was 75.5 years (range 68 to 83 years) and mean prostatic volume was 44.6 ml (range 20.2 to 71.3 ml). Seeds (65 to 122, median 90) were implanted by the real-time method of prostate interstitial irradiation. Iodine-125 radioactive seeds with a half-life of 60 d were used. The severity of the urinary symptoms was measured by the American Brachytherapy Society urinary symptom score. Level 0: no symptoms; Level I: mild to moderate urinary frequency and nocturia 2–3 times per night; Level II: moderate burning sensation, frequent urination, nocturia 4–6 times per night, or gross hematuria; Level III: severe burning sensation, frequent urination, nocturia 7–10 times per night, or gross hematuria; Level IV: urinary retention required catheterization; Level V: complications had occurred.

The indications for cTURP after implantation were refractory urinary retention. The surgeon who performed the procedure was protected with lead gloves, apron, thyroid shield, and goggles. cTURP was performed after cystoscopic examination of the bladder and prostate. The cTURP procedure was done as follows. The resectoscope sheath was fixed at the level of the verumontanum. The resecting loop was next rotated to the 12 o'clock position. The resection started at the anterior commissure. It extended laterally to either side toward 2 and 10 o'clock position and longitudinally from the bladder neck to the verumontanum. The goal of resection was to enlarge the bladder neck and to create an adequate channel (Mazur and Thompson, 1991; Aagaard *et al.*, 1994; Sehgal *et al.*, 2005). The procedure was stopped once the radioactive seeds were exposed. The freed radioactive seeds were removed and sealed in a lead container. The resected tissue was irrigated out of bladder

using an Ellik's evacuator. The chips were weighed and processed for X-ray, and then a pathological examination. A technician from the Nuclear Medicine Department was responsible for the disposal of the removed seeds. Continuous irrigation was applied for 24–48 h after cTURP until the urine drainage became very clear. The catheter was removed the following day when hemostasis was achieved. PSA of the patients was monitored regularly for up to one year.

Nine patients with refractory urinary retention underwent cTURP within six months after brachytherapy. The operative time ranged from 30 to 50 min and 1 to 5 radioactive seeds were removed. The median weight of the resected prostatic tissue was 6.5 g (range 2.9 to 15.6 g). Urinary retention was relieved postoperatively in all nine patients. The symptom scores in these patients decreased to Level 0 or Level I from Level VI (Table 1). There were no intraoperative or postoperative complications and there was no urinary incontinence resulting from the surgery. Pathological examination of the resected tissue showed mostly fibromuscular tissue with few prostatic glands. There was no evidence of cancer in six patients. Three patients were found to have residual cancer: one had a Gleason score 8 cancer; a second patient had a prostate volume greater than 60 ml before brachytherapy; and, the third patient had both a Gleason 8 prostate cancer and prostate volume of greater than 60 ml. With a mean follow-up of 16 months after cTURP (range 6 to 26 months), the mean serum PSA was 0.42 ng/ml (range 0.08 to 0.83 ng/ml). The characteristics of these 9 patients are summarized in Table 1.

## 3 Discussion

Prostate cancer is the most common malignant tumor in men in the United States (Siegel *et al.*, 2013). The prevalence has been reported to be around 14% in 60–79 years old men (Greenlee *et al.*, 2001). Brachytherapy has continued to gain popularity during the last decade because of its reliable curative effect and manageable side effects. Furthermore, brachytherapy could be performed with preservation of the sexual function making it even more desirable. Brachytherapy is now well accepted, and post-implantation complications included dysuria, urinary retention, incontinence, and gross hematuria.

**Table 1 Characteristics of the nine patients with post-brachytherapy cTURP**

| No. | Age (Year) | $V_p$ (ml) | Gleason score | PSA <sub>0</sub> (ng/ml) | $n_i/n_r$ | $t$ (month) | Urinary symptom score before/after cTURP | PSA <sub>1</sub> (ng/ml) | $m$ (g) | Pathological examination malignant |
|-----|------------|------------|---------------|--------------------------|-----------|-------------|--|--------------------------|---------|------------------------------------|
| 1   | 68         | 22.5       | 4+4           | 16.30                    | 79/1      | 2.0         | IV/0                                     | 0.54                     | 3.5     | +                                  |
| 2   | 80         | 58.7       | 3+4           | 5.90                     | 87/3      | 1.5         | IV/I                                     | 0.27                     | 4.7     | -                                  |
| 3   | 83         | 41.2       | 3+4           | 20.67                    | 82/1      | 3.5         | IV/I                                     | 0.67                     | 3.7     | -                                  |
| 4   | 77         | 56.2       | 3+4           | 15.13                    | 91/2      | 3.0         | IV/0                                     | 0.28                     | 6.1     | -                                  |
| 5   | 73         | 63.6       | 3+3           | 7.97                     | 107/3     | 5.0         | IV/I                                     | 0.08                     | 12.5    | +                                  |
| 6   | 69         | 71.3       | 3+5           | 25.61                    | 122/5     | 3.0         | IV/I                                     | 0.83                     | 15.6    | +                                  |
| 7   | 78         | 52.2       | 3+3           | 15.43                    | 94/2      | 3.5         | IV/I                                     | 0.68                     | 4.7     | -                                  |
| 8   | 74         | 20.2       | 3+4           | 18.51                    | 84/1      | 4.0         | IV/I                                     | 0.62                     | 2.9     | -                                  |
| 9   | 68         | 29.9       | 4+3           | 12.60                    | 65/1      | 2.0         | IV/0                                     | 0.37                     | 4.6     | -                                  |

$V_p$ : volume of prostate; PSA<sub>0</sub>: PSA before biopsy;  $n_i/n_r$ : seed number of implant/removed;  $t$ : interval between prostate brachytherapy and cTURP; PSA<sub>1</sub>: PSA after cTURP;  $m$ : weight of resected prostate; +: pathological examination of the resected tissue showed malignancy; -: pathological examination of the resected tissue showed no malignancy

One of the most common complications after brachytherapy was urinary retention and it has been reported to occur in 1.5% to 22% of the patients (Wallner *et al.*, 1995; Storey *et al.*, 1999; Flam *et al.*, 2000). The indications for TURP after implant were either refractory urinary retention or urinary symptoms which could not be relieved with medical therapy (Stone and Stock, 2002; Flam *et al.*, 2004). Post-implant TURP rates had been reported in 0% to 8.7% of the patients (Cavanagh *et al.*, 2000; Merrick *et al.*, 2003; Potters *et al.*, 2004). Twelve of our 190 patients (6.3%) developed urinary retention after brachytherapy.

According to current literature, most of the post-brachytherapy TURPs were performed six months after implantation (Flam *et al.*, 2004; Kollmeier *et al.*, 2005) for the following reasons: (1) The seeds for brachytherapy contain Iodine-125 radioactive isotope, which irradiates the cancer cells through the release of  $\gamma$  radiation. Iodine-125 has a half-life of 60 d and its decay will occur in 4–6 half-life cycles (about one year). Within the first six months post-brachytherapy, 87.5% of radioisotope will decay; an earlier TURP might compromise the therapeutic effect of brachytherapy. (2) Patients with urinary symptoms could often be managed with medical therapy, and surgery was reserved for patients with refractory urinary retention or failure to respond to medical treatment (Mazur and Thompson, 1991; Aagaard *et al.*, 1994; Sehgal *et al.*, 2005). (3) TURP of the freshly irradiated tissue might increase the surgical complications. TURP did not impair biological and clinical results of

brachytherapy based on the PSA values after six months when the radioactivity of the seeds had diminished (Flam *et al.*, 2004; Kollmeier *et al.*, 2005). Furthermore, it is a widely accepted fact that the seeds will likely be removed from the prostatic tissue during the procedure. On the other hand, prolonged catheterization will inevitably result in catheter-related complications and diminish the quality of life for the patients. In our study, we looked at nine patients with refractory urinary retention who underwent cTURP within six months (range 1.5 to 5.0 months) after brachytherapy. Our goal was to enlarge the bladder neck and to create a voiding channel with removal of minimum amount of prostate tissue. The average weight of our resected tissue was 6.5 g (range 2.9 to 15.6 g) and an average of 2 seeds (range 1 to 5 seeds) was removed. Urinary retention was relieved in all nine patients. There were no intra- or post-operative complications observed. With a median follow-up of 16 months (range 6 to 26 months) after cTURP, no patient showed biochemical evidence of disease progression. Mean serum PSA at the end of the follow-up was 0.42 ng/ml (range 0.08 to 0.83 ng/ml). Our results were in line with those reported for brachytherapy (Iannuzzi *et al.*, 1999; Jo *et al.*, 2005). The following factors should be considered when applying this technique. First of all, remove as little prostatic tissue as possible to achieve the desired result, namely to relief urinary retention. This should reduce the risk of surgical complications. We removed an average of 6.5 g tissue vs. about 8 g prostatic tissue as reported by Flam *et al.* (2004). Secondly, remove as few seeds

as possible. We removed an average of 2 seeds (range 1 to 5) vs. 5 seeds (range 1 to 19) as reported by Flam *et al.* (2004). This should lessen the chance of compromising the therapeutic effect of brachytherapy. The coverage area of a single seed is a spherical volume with a 5-mm radius. When a seed is removed, its irradiated prostatic tissue should be resected at the same time. Third, most of prostate cancers are located in the more posterior peripheral zones. According to literature, peripheral zone cancers made up 69.0%–79.9% of prostate cancers (Augustin *et al.*, 2003a; 2003b; Sakai *et al.*, 2006). The cTURP only removed a little tissue of transition zone but not the peripheral zone. The range of permanent seeds in the the peripheral zone after cTURP showed no difference with pre-operation according to the computerized tomography scan. Pathological examination of our resected tissue showed evidence of cancer in only three patients: one had a Gleason score of 8 before brachytherapy, one had a prostatic volume greater than 60 ml before brachytherapy, and one had both.

#### 4 Conclusions

cTURP within the first six months after brachytherapy was found to be safe and effective in relieving urinary retention and at the same time did not compromise the radiation therapy. This was evident by the fact that urinary retention was relieved in all our patients. There were no postoperative complications and no patient had biochemical evidence of cancer progression during the follow-up period. Furthermore, we feel that early cTURP will reduce catheter-related complications and improve the quality of life for the patients. It should be emphasized that this procedure should be performed with proper protection to all personnel involved.

#### Compliance with ethics guidelines

You-yun ZHANG, Zhi-gen ZHANG, Yan-lan YU, Yi-cheng CHEN, Kang-xin NI, Ming-chao WANG, Wei-ping ZHAO, Faisal REHMAN, Shaw P. WAN, and Gong-hui LI declare that they have no conflict of interest.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5). Informed consent was obtained from all patients for being included in the

study. Additional informed consent was obtained from all patients for which identifying information is included in this article.

#### References

- Aagaard, J., Jonler, M., Fuglsig, S., *et al.*, 1994. Total transurethral resection versus minimal transurethral resection of the prostate—a 10-year follow-up study of urinary symptoms, uroflowmetry and residual volume. *Br. J. Urol.*, **74**(3):333-336. [doi:10.1111/j.1464-410X.1994.tb16622.x]
- Augustin, H., Hammerer, P.G., Blonski, J., *et al.*, 2003a. Differences in biopsy features between prostate cancers located in the transition zone and peripheral zone. *BJU Int.*, **91**(6):477-481. [doi:10.1046/j.1464-410X.2003.04140.x]
- Augustin, H., Erbersdobler, A., Graefen, M., *et al.*, 2003b. Zonal location of prostate cancer: significance for disease-free survival after radical prostatectomy? *Urology*, **62**(1):79-85. [doi:10.1016/S0090-4295(03)00248-6]
- Cavanagh, W., Blasko, J.C., Grimm, P.D., *et al.*, 2000. Transient elevation of serum prostate-specific antigen following <sup>125</sup>I/<sup>103</sup>Pd brachytherapy for localized prostate cancer. *Semin. Urol. Oncol.*, **18**(2):160-165.
- Cooperberg, M.R., Lubeck, D.P., Meng, M.V., *et al.*, 2004. The changing face of low-risk prostate cancer: trends in clinical presentation and primary management. *J. Clin. Oncol.*, **22**(11):2141-2149. [doi:10.1200/JCO.2004.10.062]
- Flam, T., Chauveinc, L., Servois, V., *et al.*, 2000. Brachytherapy in the curative treatment of localized prostatic cancer. *Prog. Urol.*, **10**(1):3-13 (in French).
- Flam, T.A., Peyromaure, M., Chauveinc, L., *et al.*, 2004. Post-brachytherapy transurethral resection of the prostate in patients with localized prostate cancer. *J. Urol.*, **172**(1):108-111. [doi:10.1097/01.ju.0000132136.95221.63]
- Greenlee, R.T., Hill-Harmon, M.B., Murray, T., *et al.*, 2001. Cancer statistics, 2001. *CA Cancer J. Clin.*, **51**(1):15-36. [doi:10.3322/canjclin.51.1.15]
- Iannuzzi, C.M., Stock, R.G., Stone, N.N., 1999. PSA kinetics following I-125 radioactive seed implantation in the treatment of T1-T2 prostate cancer. *Radiat. Oncol. Investig.*, **7**(1):30-35. [doi:10.1002/(SICI)1520-6823(1999)7:1<30::AID-ROI4>3.0.CO;2-8]
- Jo, Y., Junichi, H., Tomohiro, F., *et al.*, 2005. Radical prostatectomy versus high-dose rate brachytherapy for prostate cancer: effects on health-related quality of life. *BJU Int.*, **96**(1):43-47. [doi:10.1111/j.1464-410X.2005.05564.x]
- Kollmeier, M.A., Stock, R.G., Cesaretti, J., *et al.*, 2005. Urinary morbidity and incontinence following transurethral resection of the prostate after brachytherapy. *J. Urol.*, **173**(3):808-812. [doi:10.1097/01.ju.0000152698.20487.0e]
- Mazur, A.W., Thompson, I.M., 1991. Efficacy and morbidity of 'channel' TURP. *Urology*, **38**(6):526-528. [doi:10.1016/0090-4295(91)80170-C]
- Merrick, G.S., Butler, W.M., Wallner, K.E., *et al.*, 2003. Long-term urinary quality of life after permanent prostate brachytherapy. *Int. J. Radiat. Oncol. Biol. Phys.*, **56**(2):

- 454-461. [doi:10.1016/S0360-3016(02)04600-X]
- Potters, L., Klein, E.A., Kattan, M.W., et al., 2004. Monotherapy for stage T1-T2 prostate cancer: radical prostatectomy, external beam radiotherapy or permanent seed implantation. *Radiother. Oncol.*, **71**(1):29-33. [doi:10.1016/j.radonc.2003.12.011]
- Sakai, I., Harada, K., Kurahashi, T., et al., 2006. Analysis of differences in clinicopathological features between prostate cancers located in the transition and peripheral zones. *Int. J. Urol.*, **13**(4):368-372. [doi:10.1111/j.1442-2042.2006.01307.x]
- Sehgal, A., Mandhani, A., Gupta, N., et al., 2005. Can the need for palliative transurethral prostatic resection in patients with advanced carcinoma of the prostate be predicted? *J. Endourol.*, **19**(5):546-549. [doi:10.1089/end.2005.19.546]
- Siegel, R., Naishadham, D., Jemal, A., 2013. Cancer statistics, 2013. *CA Cancer J. Clin.*, **63**(1):11-30. [doi:10.3322/caac.21166]
- Stone, N.N., Stock, R.G., 2002. Complications following permanent prostate brachytherapy. *Eur. Urol.*, **41**(4):427-433. [doi:10.1016/S0302-2838(02)00019-2]
- Storey, M.R., Landgren, R.C., Cottone, J.L., et al., 1999. Transperineal <sup>125</sup>Iodine implantation for treatment of clinically localized prostate cancer: 5-year tumor control and morbidity. *Int. J. Radiat. Oncol. Biol. Phys.*, **43**(3):565-570. [doi:10.1016/S0360-3016(98)00451-9]
- Wallner, K., Roy, J., Harrison, L., 1995. Dosimetry guidelines to minimize urethral and rectal morbidity following transperineal I-125 prostate brachytherapy. *Int. J. Radiat. Oncol. Biol. Phys.*, **32**(2):465-471. [doi:10.1016/0360-3016(94)00599-G]
- Whitmore, W.F.Jr., Hilaris, B., Grabstald, H., 2002. Retropubic implantation of iodine 125 in the treatment of prostate cancer. *J. Urol.*, **167**(2):981-983.

## 中文概要:

**本文题目:** 早期经尿道前列腺隧道式电切治疗前列腺癌近距离照射治疗术后尿潴留

**Early channel transurethral resection of the prostate for patients with urinary retention after brachytherapy**

**研究目的:** 探讨早期经尿道前列腺隧道式电切治疗前列腺癌近距离照射治疗术后尿潴留的适应症及其对近距离照射治疗疗效的影响。

**创新要点:** 前列腺癌近距离照射治疗已经成为 75 岁以上患者的首选, 前列腺癌近距离照射治疗术后尿潴留发生率为 1.5%~22.0%。经尿道前列腺电切常用于药物治疗无效的反复尿潴留患者, 且手术时机多在近距离照射治疗术后 6 个月以后。经尿道前列腺隧道式电切治疗前列腺癌近距离照射治疗术后尿潴留可在 6 个月内进行, 患者尿道症状从 IV (出现尿潴留, 需要导尿) 下降为 0 级 (没有症状) 或 I 级 (轻度, 中度尿频, 2~3 次/晚), 较术前改善明显, 且对近距离照射治疗疗效无明显影响。

**研究方法:** 浙江大学医学院附属邵逸夫医院 2009 年 2 月至 2013 年 7 月间所有接受前列腺癌近距离照射治疗的病例共 190 例, 其中 9 例 (4.7%) 患者术后出现反复尿潴留, 且早期行经尿道前列腺隧道式电切术治疗, 回顾分析其临床资料。

**重要结论:** 前列腺癌近距离照射治疗术后反复尿潴留, 在严格防护下早期行经尿道前列腺隧道式电切是安全有效的, 且电切后对近距离照射治疗疗效无明显影响。

**关键词组:** 早期; 前列腺癌; 近距离照射治疗; 经尿道前列腺电切