Remote After Loading HDR Brachytherapy for Female Urethral Cancer

Jeong Gil Cho, M.D., Eun Kyung Choi, M.D., Hyesook Chang, M.D.
Byong Yong Yi, M.S., Kwang Hoon Kim, M.D.* and Jong Goo Lee, M.D.*

Department of Therapeutic Radiology, Urology, Asan Medical Center*
College of Medicine, University of Ulsan, Seoul, Korea

In our institution, a 76-year-old woman with primary urethral carcinoma was treated with remote afterloading high dose rate (HDR) interstitial brachytherapy using micro selectron Ir-192. In this paper, authors described the technical aspect of remote afterloading HDR interstitial brachytherapy for female urethal cancer.

Key Words: Female urethral cancer, HDR Brachytherapy

INTRODUCTION

Primary carcinoma of the female urethra is an uncommon disease and may be curable in its early stages by radiation therapy or surgery alone. Apporoximately 1200 cases of female urethral cancer have been reported in the literature and this disease accounts for less than 0.02% of malignant disease in woman. The mainstay of treatment is surgical resection. Radiation therapy has been employed for post-op adjuvant therapy or alone for patients with regionally advanced disease.

In female urethral carcinoma treated by surgery or RT alone, the 5-year survival rate varies from 30% to 40%. Continuous low dose rate brachytherapy with gold, radon seed or radium needle implantation was reported in the literature but high dose rate brachytherapy for female urethral carcinoma was not found in the literature.

In our institution, a 76-year-old woman with primary urethral carcinoma was treated with remote afterloading HDR interstitial brachytherapy, 30 Gy in 12 fractions in 6 days after external beam irradiation of 59.4 Gy in 7 weeks. We present our experience and technique for remote afterloading HDR interstitial brachytherapy for female urethal cancer.

MATERIALS AND METHODS

1. Case Report

A 76-year old woman who complained of dysuria for 2 years and hematuria for 2 months presented with a large obstructing urethral mass and the biopsy confirmed adenocarcinoma. She was treated with external beam 45 Gy in 25 fractions to the whole pelvis and a boost of 14.4 Gy in 8 fractions to the tumor bed using AP-PA portals with 6MV X-ray. The CT scan obtained just after completion of rdiotherapy showed a large residual mass (Fig. 1). Then, she was treated with interstitial brachtherapy. She received 30 Gy in 12 fractions in 6 days, utilizing micro selectron HDR I_r-192.

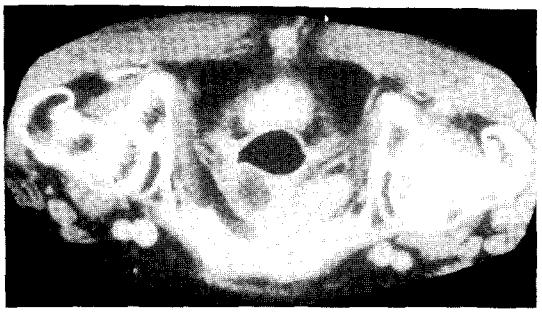

Fig. 1-1. CT scan after teletherapy.

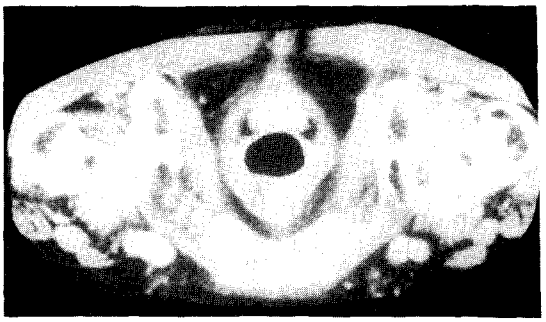

Fig. 1-2. CT scan after brachytherapy.

2. Brachytherapy Method

Under general anesthesia, cystoscopy was performed and the fungating, necrotic mass at mid-urethra was biopsied. The frozen section confirmed the diagnosis. The protruding mass in anterior vaginal wall got smaller during palpation after necrotic tissue was drained out through the urethra. Foley catheter was inserted and mass was measured by palpation; 4 cm long, 2 cm width and 1.5 cm depth. Voume implant using 3 catheters were planned.

— Technique for the insertion of afterloading applicators (Fig. 2) —

1) We planned to implant the flexible catheter which is commonly utilized in 2-end implant i.e. breast implant. This flexible catheter has the thicker part and the thinner part, inner diameter 1.5 mm and 0.6 mm, respectively. (Fig. 2-A)

2) For implantation of flexible catheter, 18 gauge, 20 cm long stainless steel needle was interstitially placed into mass guided by operator's left hand. Thinner part of flexible catheter can be inserted into the needle. (Fig. 2-A)

3) Guidewire with diameter of 0.5 mm was inserted through the 18 G needle from the distal end and it was pulled out of the vagina. (Fig. 2-B)

4) Then the tip of the guidewire was inserted into the thin part of the flexible catheter with inner diameter of 0.6 mm. (Fig. 2-B)

5) Pushing the guidewire with the flexible catheter towards the proximal end of needle, thin part of flexible catheter can be inserted into the proximal end of 18 G needle. (Fig. 2-C, D)

6) Flexible catheter was pulled down and button-end of flexible catheter was anchored on tumor, the distal open end will be connected to the brachytherapy unit. (Fig. 2-E, F)

7) 2 flexible catheters were implanted into the mass, 1.5 cm apart from each other.

8) One more catheter (5 Fr endobronchial catheter) was inserted through the Foleyh catheter. (Fig. 2-F)

9) Vaginal packing was placed to displace the rectum posteriorly.

— Remote afterloading HDR Brachytherapy —

1) Dummy sources were inserted into the catheters and orthogonal films were taken and target volume was defined. (Fig. 3)

2) CT was taken with dummy sources in the catheter, to document the position of source in the tumor.

3) The position of catheter was not ideal for the target volume, but the treatment planning computer generated the optimal isodose curve to encompass the tumor volume by optimizing the dwell position and dwell time of sources. (Fig. 4-1)

4) Fig. 4-2 shows the isodose line. Thick line

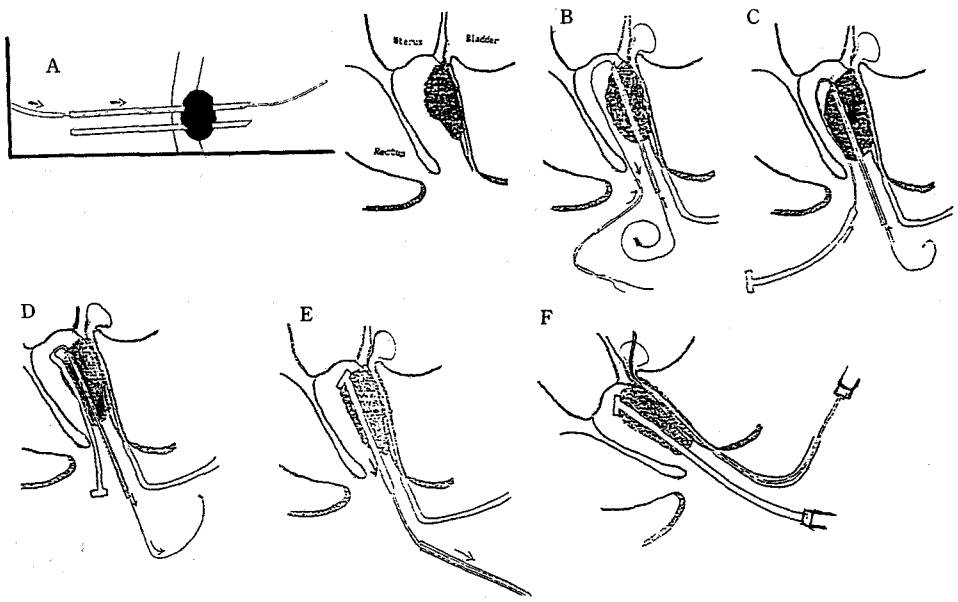

Fig. 2. the schematic drawing of the procedure for insertion of the afterloading flexible catheter.

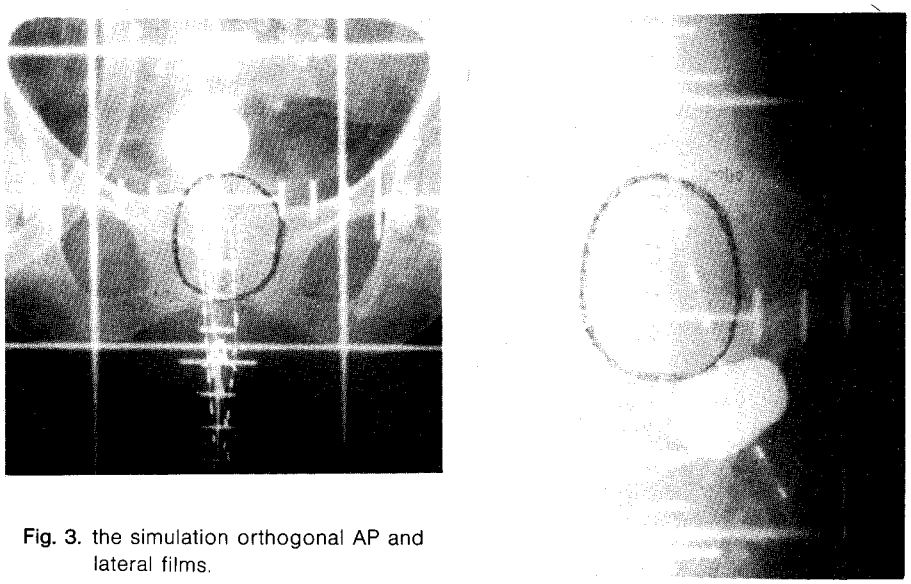

Fig. 3. the simulation orthogonal AP and lateral films.

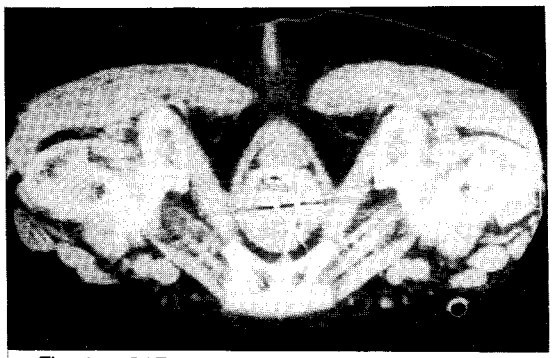

Fig. 4-1. CAT with dummy sources in the lesion.

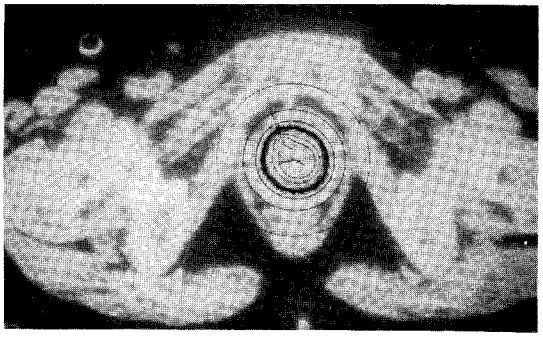

Fig. 4-2. Isodose line superimposed on the CAT -scan.

represents the 250 cGy isodose line.

5) We prescribed 250 cGy/fraction, 2 fraction/day with 6 or more hours interval and total dose of 3000 cGy/12fx in 6 days.

6) Interstitial catheters were placed for 7 days and antibiotics were given during these period. Patient was able to move around for daily routine

DISCUSSION

The length of female urethra ranges 2.5 cm to 4 cm. The lining epithelium of the distal urethra is squamous epithelium and it becomes transitional epithelium toward the urinary bladder. The urethra contains the periurethral or skene's glands[1].

Histological classification of urethral cancer include squamous cell carcinoma, adenocarcinoma, transitional cell carcinoma, melanoma and others (Table 1). The lymphatics of distal urethra drains to the inguinal lymph nodes, while the proximal urethra drains to the deep pelvic nodes. Approximately 30% of the patients present with palpable inguinal nodes and most of them represent metastatic spread[2].

There are 2 commonly used staging systems, the Grabstald system, which is based on pathologic finding and the Prempree system, which is a clinical staging system (Table 2). Staging has been found to be of prognostic value[2,3]. Bracken et al, found 5-year survival rates of 40~45% in patients with stage A-B cancers and 20~25% in patients with stage C-D tumors[4]. Cassandra et al, reported 5-year survival rates of 41% of patient with stage I disease and 25~32% of those with stage II-IV

Table 1. The Tumor Histology of Female Urethral Cancer

Tumor Histology	Patients	Frequency (%)
Squamous Cell	345	58
Transitional Cell	95	16
Adenocarcinoma	103	17
Other	51	9
Total	594	100

Table 2. Staging System

Prempree System

- I : Disease limited to distal half of urethra
- II : Entire urethra, with extension to periurethral tissues, but not involving vulva or bladder neck
- III : a ; Urethra and vulva
  - b ; Urethra and vaginal muscle
  - c ; Urethra and bladder neck
- IV : a ; Parametrium or paracolpium
  - b ; Metastases
    - 1 : Inguinal nodes
    - 2 : Pelvic nodes
    - 3 : Para-aortic nodes
    - 4 : Distant metastases

Grabstald System

- Stage O (Tis) In situ
- Stage A (T1) Submucosal
- Stage B (T2) Muscular
- Stage C (T3–4) Periurethral
  - C–1 Muscular wall of the vagina
  - C–2 Muscular wall of the vagina with invasion of vaginal mucosa
  - C–3 Infiltration of other adjacent Structure
- Stage D (N+/M+) Metastasis
  - D–1 Inguinal lymph nodes
  - D–2 Pelvic lymph nodes below the bifurcation of the aorta
  - D–3 Lymph nodes above the bifurcation of the aorta
  - D–4 Distant

tumor[5].

The selection of treatment by radiotherapy or surgery or a combination of both depends on clinical stage. Surgery varied from local excision to anterior exenteration. Pointon & Poole-Wilson suggested that the role of surgery should be 1) to salvage patients with recurrent tumors following radiation therapy or excision 2) for primary treatment of patients with deep urethral lesion causing urinary obstruction 3) treatment of radioresistant tumors such as melanoma and sarcoma[6].

Table 3–1. Treatment Results for Early Stage Urethral Carcinoma

	No. Pts.	Tx	5 YSR (%)
Grabstald	25	RT	3/11 (27)
		S	8/11 (73)
		RT+S	2/ 3 (67)
Taggart	15	RT	8/15 (53)
Weghaupt	42	RT	30/42 (71)

Table 3–2. Treatment Results for Advanced Stage Urethral Carcinoma

	No. Pts.	Tx	5 YSR (%)
Grabstald	54	RT	1/19 (5)
		S	3/15 (20)
		RT+S	5/20 (25)
Taggart	22	RT	4/22 (18)
Weghaupt	20	RT	10/20 (50)

Grabstald et al. recommended the partial urethrectomy as the treatment of choice for disease limited to the anterior urethra. The advanced urethral tumors was managed by pre-op radiation theapy and surgery, such as anterior exenteration. Radiotherapy was given with external beam and interstitial implant, in combination or alone[2].

Antoniades et al. indicated that carcinoma of the meatus best treated by interstitial therapy in doses between 5,500 and 6,000 rads. Advanced urethral carcinoma was treated by both external radiation in combination with an interstitial radium implantation[7].

Taggart et al. used the interstitial brachytherapy if the disease was localized to the anterior urethra, a double plane or a volume implant radium needles. The doses was 7,000 rads in 7 days. For larger tumors, external irradiation and interstitial brachytherapy was used; 4,000 to 6,000 rads in 4 to 6 weeks followed by an additional 3,000 to 4,000 rads in 3 to 4 days with an interstitial implant. A few patients with marked extension to vulva or bladder,

was treated by external irradiation only, a total dose of 7,000 rads in 7 weeks using a 4 field box technique[8].

Weghaupt et al. treated the primary tumor with 3 sequential intracavitary vaginal irradiation followed by external beam irradiation 30 Gy. For posterior lesions a vaginal applicator was combined with an intrauterine sound containing radium. For tumors of the proximal urethra a thin intraurethral sound mounted on an indwelling catheter was applied[9].

Cassandra et al. compared the effectiveness of surgery, radiation therapy and combined surgery and radiation therapy. 5-vear survival rates for the three groups were similar, 33%, 37% and 28%, respectively. They also evaluated the effectiveness of interstitial implantation, external beam irradiation, and combined interstitial and external beam irradiation. They recommended a dose of 40~45 Gy in $4^1/_2$-5 weeks through portals which encompass the first echelon of lymph node drainage, and additional 20~30 Gy to the primary tumor with an interstitial implant[5].

The role of chemotherapy is not well established. At M.D. Anderson hosptial, they tried neoadjuvant chemoitherapy consisting of 2 cycles of methotrexate, cisplatin and vinblastin given before radiation therapy and cisplatin given every 3 weeks during radiation therapy (6,000 to 6,500 cGy) in 2 patients with advanced transitional cell cancer[10].

In our case, she was treated with external beam 45 Gy in 25 fractions to the whole pelvis and a boost of 14.4 Gy in 8 fractions to the tumor bed using AP-PA portals with 6 MV X-ray and additional 30 Gy in 12 fractions in 6 days with interstitial volume implant through 2 interstitial catheter and 1 catheter in the urethra. Two months after completion of brachytherapy, she complained of mild dysuria but hematuria was subsided. Pelvic examination revealed the diffuse thickening of anterior vaginal wall but there was no palpable discrete mass. Follow up CT showed significant regression of tumor.

In conclusion, interstitial brachtherapy is an effective means of treating an early female urethral cancer. Radiation therapy alone by external beam and brahytherapy, or combined with limited surgery may offer an excellent chance not only for cure, but also conservation of urethral function. Advanced stage disease should be approached in combination of surgery, radiation therapy and possibly chemotherapy.

REFERENCES

1. **Johnson DE, O'Connell JR:** Primary carcinoma of female urethra. Urology 21:42-45, 1983
2. **Grabstald H, Hilaris S, Henschke J, Whitmore WF:** Cancer of the female urethra. JAMA 197:835-842, 1966
3. **Prempree T, Amornmarn R, Patanaphan V:** Radiation therapy in primary carcinoma of the female urethra. An update on results. Cancer 54:729-733, 1983
4. **Bracken RB, Johnson DE, Miller LS, Ayala AG, Gomez JJ, Rutledge FN:** Primary Carcinoma of the female urethra. J Urol 116:188-192, 1976
5. **Cassandra SF, David HH, John JS, J Fred Doornbos, B-chen Wen, Antonio PV:** A comparison of the roles of surgery and radiation therapy in the management of of carcinoma of the female urethra. Int J Radiation Oncology Biol Phys 21:961-968, 1991
6. **Pointoin RCS, Poole-Wilson DS:** Primary carcinoma of the urethra. Brit J Urol 40:682-693, 1968
7. **Antoniades J:** Radiation therapy in carcinoma in the female urethra. Cancer 24:70-76, 1969
8. **Taggart CG, Castro JR, Rutledge FN:** Carcinoma of the female urethra. Am J Roentgenol 114:145-151, 1972
9. **Weghaupt K, Gerstner GJ, Kucera H:** Radiation therapy for primary carcinoma of the female urethra: a survey over 25 years. Gynec Oncol 17:58-63, 1984
10. **Scott LS, William US, CC Wang:** Carcinoma of the female urethra: A review of results with radiation therapy. J Urol 140:1-5, 1988

= 국문초록 =

여성 요도암의 원격조정 고선량 근접치료

울산대학교 의과대학 서울중앙병원, 치료방사선과학교실, 비뇨기과학교실*

조정길 · 최은경 · 장혜숙 · 이병용 · 김광훈* · 이종구*

여성 뇨도암은 극히 드문 종양으로 그 치료법에 대해서는 수술과 방사선 치료가 주종을 이룬다. 본원에서 micro Selectron I_r-192를 이용하여 원격조정 고선량 근접치료를 시행했는데 시술의 기술적인 측면을 소개하고 문헌고찰을 기술한다.