Salvage Therapy with Intraoperative Cesium-131 for Recurrent Ovarian Cancer

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Abstract

Recurrent ovarian cancer is considered incurable and the current standard of treatment (surgery and chemotherapy) is palliative. For isolated, localized recurrent tumor, brachytherapy with Cesium-131 is a promising treatment because of its localized radiation yet limited exposure to healthy tissue. Compared to its predecessors, Cs-131 has a very short half-life, allowing for highly localized radiation that decreases toxicity of treatment and convenience for the patient. Our case shows a patient diagnosed with recurrent ovarian cancer metastatic to the right paraaortic odes. The first successful application of Cs-131 brachytherapy was performed with 100% local control without added toxicity. This shows a favorable addition to the current standard of care for highly localized ovarian cancers.

Keywords: Brachytherapy; Cesium-131; Recurrent Ovarian Cancer

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Consent: Consent was taken from the patient for publication of this case report.

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Introduction

Ovarian cancer accounts for the most deaths among reproductive cancers in American women [1]. Despite high rates of clinical remission following primary therapy, the recurrence rate among ovarian carcinoma remains high and recurrent ovarian carcinoma is considered incurable. Thus, treatment for recurrent ovarian cancer is palliative, usually consisting of surgery and/or chemotherapy. In cases of an isolated, localized recurrent tumor, brachytherapy may be an effective treatment for recurrent ovarian cancer because of its localized, high-dose radiation and its ability to limit radiation exposure to healthy tissue. Cesium-131 (Cs-131) is an FDA-cleared radioisotope used for brachytherapy which has physical and radiobiological advantages over its predecessors (Iodine-125 and Palladium-103). Specifically, Cs-131 has a very short half-life of 9.7 days allowing for 90% of the intended dose to be delivered in approximately one month. Not only does brachytherapy with Cs-131 allow the immediate release of radiation and thus tumor all-kill, which results in prevention of tumor cell repopulation, the rapid radiation dose delivery allows for earlier initiation of subsequent systemic chemotherapy. We present the first case of successful application of Cs-131 in a patient with recurrent ovarian cancer.

Case Presentation

Patient History and Examination:
The patient is a 66 year old Asian female with a history of grade I, stage 1B endometrioid endometrial and stage IC synchronous ovarian cancer who underwent hysterectomy, bilateral salpingo-oophorectomy, and lymph node dissection on July 2003 followed by six cycles of adjuvant chemotherapy consisting of carboplatin and paclitaxel. The patient was disease-free and asymptomatic until December 2010 when she presented with lower back pain that had radiated to her lower abdomen. A PET/CT scan on December 2010 demonstrated a new soft tissue mass 2 cm superior to the aortic bifurcation which was suspicious for nodal metastasis (Figure 1A). In addition, there were two new soft tissue nodules in the high right common iliac region as well as a ureteral obstruction (Figure 1B). A percutaneous biopsy of the suspected lymph nodes was attempted but unsuccessful.

Based on the pre-operative CT scan, the patient underwent a robotic-assisted periaortic lymph node dissection and tumor debulking with intraoperative placement of Cs-131 vinyl stranded seed brachytherapy. A left ureteral stent was introduced and a right ureterostomy was performed. The patient underwent a near complete bilateral periaortic lymph node dissection leaving small residual disease in the inferior vena cava and inferior mesenteric artery which was deemed unresectable. A frozen section had been obtained from one segment of lymphadenopathy, which returned as consistent with malignant cells. Final pathology demonstrated poorly differentiated carcinoma infiltrating perinodal fibrous tissue, consistent with recurrent ovarian cancer. All lymph nodes were negative for metastatic carcinoma.

The intraoperative Cesium-131 (Cs-131) brachytherapy seeds were applied to the areas of residual disease. Cs-131 brachytherapy seeds were stranded on a suture and were threaded through Vicryl mesh. Thirty seeds with activity of 2.4 U/seed were implanted amounting to a total dose of 80 Gy prescribed to a 5 mm depth (Figure 1C-F). Postoperatively, the patient was given 6 cycles of adjuvant chemotherapy with gemcitabine and carboplatin.
Figure 1 A PET/CT scan of the abdominal/pelvic region. A. Green markings indicate a new soft tissue 2 cm mass superior to the aortic bifurcation which is suspicious for neoplastic lymph node. B. Two new soft tissue nodules in the high right common iliac region suspicious for periaortic recurrence of ovarian cancer. Computed tomography scans of Cs-131 brachytherapy seeds in the postoperative resection cavity. C. Axial plane. D. Coronal plane. E. Sagittal plane. D: Three-dimensional radiation cloud from the 80-Gy isodose line F. Enlarged axial view of isodose lines.
CT scans of the abdomen and pelvic region were performed routinely, every 6 months after the resection, to assess the residual tumors and recurrence of disease. A post-operative CT scan showed an edema containing para-aortic collection resulting from postsurgical changes and fat necrosis from brachytherapy.

Another PET scan a year after diagnosis showed no residual metabolic activity within the infiltrating para-aortic and retroperitoneal mass and complete resolution of edema and fat necrosis. The patient remained asymptomatic from the implant. Subsequent PET-CT scans (with the last one obtained in June 2014 – Figure 2) revealed no recurrent disease and 100% local control of the implanted area.

![Figure 2](image.png)

**Figure 2** A PET-CT scan obtained 4.5 years later indicates no local recurrence in the area treated with brachytherapy.

**Discussion**

Epithelial ovarian carcinomas account for 90% of all ovarian cancers [1]. Endometrioid epithelial ovarian cancers account for 16 - 25% of these cases [2]. The current palliative treatment consists of surgery (hysterectomy and bilateral salpingo-oophorectomy) [3] and chemotherapy. Despite treatment, a recurrence rate of 60-70% has been reported. The current typical palliative treatment for recurrent ovarian cancer is combination platinum-based chemotherapy [4].

Radiotherapy is a less common method of treatment, but when it is involved, whole abdomen radiation therapy (WART) or pelvic irradiation has been used. Studies have shown that patients with residual tumor have higher 5-year improvement rates with abdominopelvic radiotherapy and pelvic radiotherapy compared to abdominopelvic radiotherapy and chemotherapy [5]. Complications such as
severe bowel toxicity [6] and the increased use of chemotherapy in treating ovarian cancer have decreased the use of radiotherapy in treatment. Brachytherapy can reduce these negative side effects of external radiation by localizing high radiation doses and limiting radiation to normal tissues, and thus potentially sparing a patient severe toxicity. However, such application is best suited for highly localized tumor occurrences such as in our patient. In the cases of residual disease of positive margins requiring post-operative external-beam radiation, brachytherapy can be a very effective method which replaces the commute, length of treatment, and toxicities associated with radiotherapy. Brachytherapy seeds can be implanted at time of resection and thus is a convenient and attractive option for patients obviating further commute associated with adjuvant external beam radiotherapy.

Recently, Cesium-131 (Cs-131) has been introduced as a promising novel FDA-cleared radioisotope with superior radiobiological and physical properties to other radioactive isotopes (such as Iodine-125 and Palladium-103), having a shorter half-life and strong photon energy (9.7 days and 29 keV) (7). This allows much of the total dose to be delivered in a shorter span of time than the two other radioisotopes; effectively, 90% of the intended dose is delivered within ~1 month thereby allowing for the initiation of systemic therapy [7]. Furthermore, Cs-131 has favorable properties such as good dosimetric coverage and limited exposure to staff [8]. A study by Henschke et al also noted beneficial absorption characteristics; for example, radiation can be greatly reduced by lead foil, allowing shielding of other structures and healthy tissue [9].

Brachytherapy with Cs-131 has yet to be used in ovarian cancer but has been used successfully in treating other diseases. A study by Wooten treating gynecologic malignancies with Cs-131 brachytherapy seeds demonstrated an 84.4% local regional control with no severe side effects reported [10]. We report the first application of Cs-131 brachytherapy in a locally recurrent ovarian cancer where such treatment conferred 100% local control without added toxicity.

**Conclusion**

This patient is the first of the authors’ knowledge to be successfully treated with Cs-131 brachytherapy seeds for recurrent ovarian cancer. We suggest the use of brachytherapy for curative treatment of recurrent ovarian cancer in the case of residual disease. More research is underway to standardize treatment guidelines and dosimetric coverage for application of Cs-131 to the periaortic region.

**Conflict of Interest**

The authors have no conflict of interest in this research or manuscript preparation.

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