Adjuvant radiotherapy for endometrial cancer in a patient with pelvic kidney

CASE REPORT

A 54-year-old female patient with history of renal transplantation due to chronic kidney disease, under immunosuppressive treatment with mycophenolate and sirolimus, are also indicated as adjuvant treatment for patients with intermediate risk, high risk or unfavorable histology, for their improvement in local control and progression-free survival\(^2\)\(^3\)\(^4\).

We report the case of a patient with renal transplant, who received pelvic radiation therapy in the setting of adjuvant treatment for endometrial cancer.

A 54-year-old female patient with history of renal transplantation due to chronic kidney disease, under immunosuppressive treatment with mycophenolate and sirolimus. During gynecologic examination, an endocervical polyp was detected and biopsies of the polyp, cervix and endometrium were performed. The diagnosis was endometrioid carcinoma of the endometrium. Imaging studies showed a large mass in the uterine fundus that extended to the left uterine ostium, without suspicious lymph nodes or distant metastases. A single kidney was present on the right iliac fossa.

The patient was submitted to total hysterectomy with bilateral salpingectomy and oophorectomy and...
bilateral pelvic lymphadenectomy. Histopathological examination revealed mixed carcinoma of endometrium with a predominant endometrioid component (moderately differentiated, 95%) and a serous component (5%). Invasion of the cervical stroma was present, but not parametrial involvement. The left ovary was invaded. None of the ten lymph nodes dissected had cancerous cells. The tumor was staged as pT3a pN0 M0 and as International Federation of Gynecology and Obstetrics (FIGO) stage IIIA.

The patient was then submitted to four courses of carboplatin/paclitaxel chemotherapy, which were well tolerated, followed by radiation therapy.

Before radiotherapy, initial laboratory tests were taken and renal function was found normal. The patient was informed of the benefits and risks of radiation therapy. For treatment planning, a computed tomography with 3-millimeter slices was obtained, with a full bladder and empty rectum. The clinical target volume (CTV) and organs at risk (bladder, rectum, renal graft, femoral heads and bowel bag) were contoured. CTV was defined according to RTOG (Radiation Oncology Group) 0418: it included the upper 3 cm of the vagina and 1 cm below the obturator foramen, paravaginal soft tissues and the common, external iliac, internal iliac and presacral lymph node regions. Planning Target Volume (PTV) was obtained expanding the CTV of the tumor bed with a 10 mm margin and the CTV of the lymph node regions with a 7 mm margin, both in all directions.

Forty-five Gy at 1.8 Gy per fraction (25 fractions) were prescribed using IMRT (Intensity-Modulated Radiation Therapy) (Figure 1). This allowed the delivery of a therapeutic dose to the target volume, with an adequate coverage of the PTV (95% of the volume of PTV received 99.1% of the prescribed dose) and a reduced dose to the organs at risk (within tolerable constraints defined by RTOG 0418 and QUANTEC (Quantitative Analyses of Normal Tissue Effects in the Clinic)) (Figure 2). The graft received a mean dose of 6.4 Gy and 28% of its volume received a maximum dose of 7.5 Gy (Table I).

After external beam radiation therapy, the patient was submitted to high-dose-rate vaginal brachytherapy, with 15 Gy at 5 Gy per fraction (3 fractions). Both radiation treatments were well-tolerated.

After one year of follow-up, the patient remains free of disease and maintains normal renal function.

**DISCUSSION**

Radiotherapy is one of the most commonly used treatments given to cancer patients. However, it is associated with adverse effects and, in the particular case of patients with kidneys near the radiation field, there is an increased risk of nephrotoxicity. Therefore, in patients with renal transplant submitted to pelvic radiation therapy, graft function preservation is also a goal to achieve. Since critical organs should not have their dose tolerance exceeded due to the increased risk of toxicity, the dose received by the renal graft must be...
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How to carefully take into consideration during treatment planning. However, data regarding tolerance dose of the transplanted kidney is sparse.

Among the studies currently used as reference to indicate tolerance dose of critical organs, none considers the existence of a single kidney. Both QUANTEC, Emami et al. and RTOG consensus establish tolerance constraints while considering the presence of bilateral kidneys. And among the few case reports and small series with patients with transplanted kidney treated with pelvic radiotherapy, we only found three articles that had any dosimetric information about the graft. Dahlke et al. did a retrospective analysis of nine patients with renal transplant and pelvic cancer (prostate, rectal, anal carcinoma and Hodgkin lymphoma) treated with radiotherapy. The mean dose to the graft was between 0.1 Gy and 6.4 Gy. No one had transplant failure. Mohiuddin et al. reported on a patient with a transplanted kidney submitted to adjuvant radiotherapy for cervical cancer. No more than 28% of the graft received 10 Gy and she also did not have any decrement in renal function. Detti et al. described a case of a patient with prostate cancer that maintained normal renal function after receiving a mean dose of 1.88 Gy to the transplanted kidney.

In order to reduce the dose to the graft, as well as the remaining critical organs located in the vicinity of the treatment volume (such as bladder, rectum, femoral heads and bowel bag), the technique of radiotherapy must also be chosen carefully. IMRT is a technique that produces a more conformal volume than conventional 3D-conformal radiation therapy, providing an optimized coverage of the target volume, with a rapid fall-off gradient between the target and the surrounding normal tissues, reducing the dose to the organs at risk.

**TABLE I. MEAN DOSE TO ORGANS AT RISK**

<table>
<thead>
<tr>
<th>Organs at risk</th>
<th>Mean dose (Gy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renal graft</td>
<td>6.4</td>
</tr>
<tr>
<td>Bladder</td>
<td>37.9</td>
</tr>
<tr>
<td>Rectum</td>
<td>38</td>
</tr>
<tr>
<td>Bowel bag</td>
<td>18.4</td>
</tr>
<tr>
<td>Right femoral head</td>
<td>25.9</td>
</tr>
<tr>
<td>Left femoral head</td>
<td>29.3</td>
</tr>
</tbody>
</table>

**FIGURE 2.** Dose-volume histogram of percentage dose to the tumor bed CTV (red), nodal CTV (dark blue), renal graft (purple), bladder (yellow), rectum (dark green), bowel bag (brown), right (light green) and left femoral heads (light blue)
Previous studies have shown that it is associated with less acute\textsuperscript{17,18} and chronic\textsuperscript{18,19} toxicity than 3D-conformal radiation therapy.

The patient was also submitted to high-dose-rate vaginal brachytherapy, where a radioactive source is placed temporarily inside the vagina. This gives an additional boost with high-dose localized radiation to the vagina and, because it has a steep dose gradient, the surrounding organs receive a very low dose\textsuperscript{20}.

In conclusion, even though the presence of a renal graft near the radiation field may have an adverse impact on treatment delivery, it is possible to treat patients with pelvic cancer and kidney transplant. IMRT can provide an acceptable target coverage, while sparing the organs at risk, including the graft. To preserve graft function, its dose should be as low as possible, without compromising the target volume. A mean dose of 6.4 Gy seems to be well-tolerated by the graft in order to maintain normal renal function.

REFERENCES


ENDEREÇO PARA CORRESPONDÊNCIA
Cátia Pedro
E-mail: catia.mpedro@gmail.com

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