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HDR Cylinder Treatment for Endometrial Cancer

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Radiation Therapy

Radiation therapy is the treatment of cancer by delivering a high dose of radiation precisely to the tumor, while limiting the dose of radiation received by the surrounding non-cancerous tissues. Approximately 75% of all patients with cancer receive radiation therapy treatment (Long, Rollins, & Smith, 2019).

Initial diagnostic images are taken to determine the grading and staging of the cancerous tumor. The grade describes the appearance of the cancerous cells, and the stage describes the size of the tumor and how far it has spread.

The radiation oncologist determines the plan for the patient, including if radiation should be used in combination with surgery and/or chemotherapy, the amount of radiation used in treatment, and the number of fractions of radiation treatment overall (Long et al., 2019).

Brachytherapy

Brachytherapy is a form of radiation therapy that consists of placing sealed, radioactive sources directly into or next to the cancerous tumor that is being treated (Chargari et al., 2019).

HDR Cylinder Treatment

High Dose Rate, or "HDR," Cylinder Treatment is an invasive form of brachytherapy that is used to treat cervical and/or endometrial cancer. This procedure reduces the risk of habitual tissue complications by providing high dose radiotherapy directly to the malignancies. This occurs through the passage of a cylinder that is inserted in the patient's vaginal canal (Wierzbicka, Mańkowska-Wierzbicka, Cieślęwicz, Stelmach-Mardas, & Mardas, 2021).

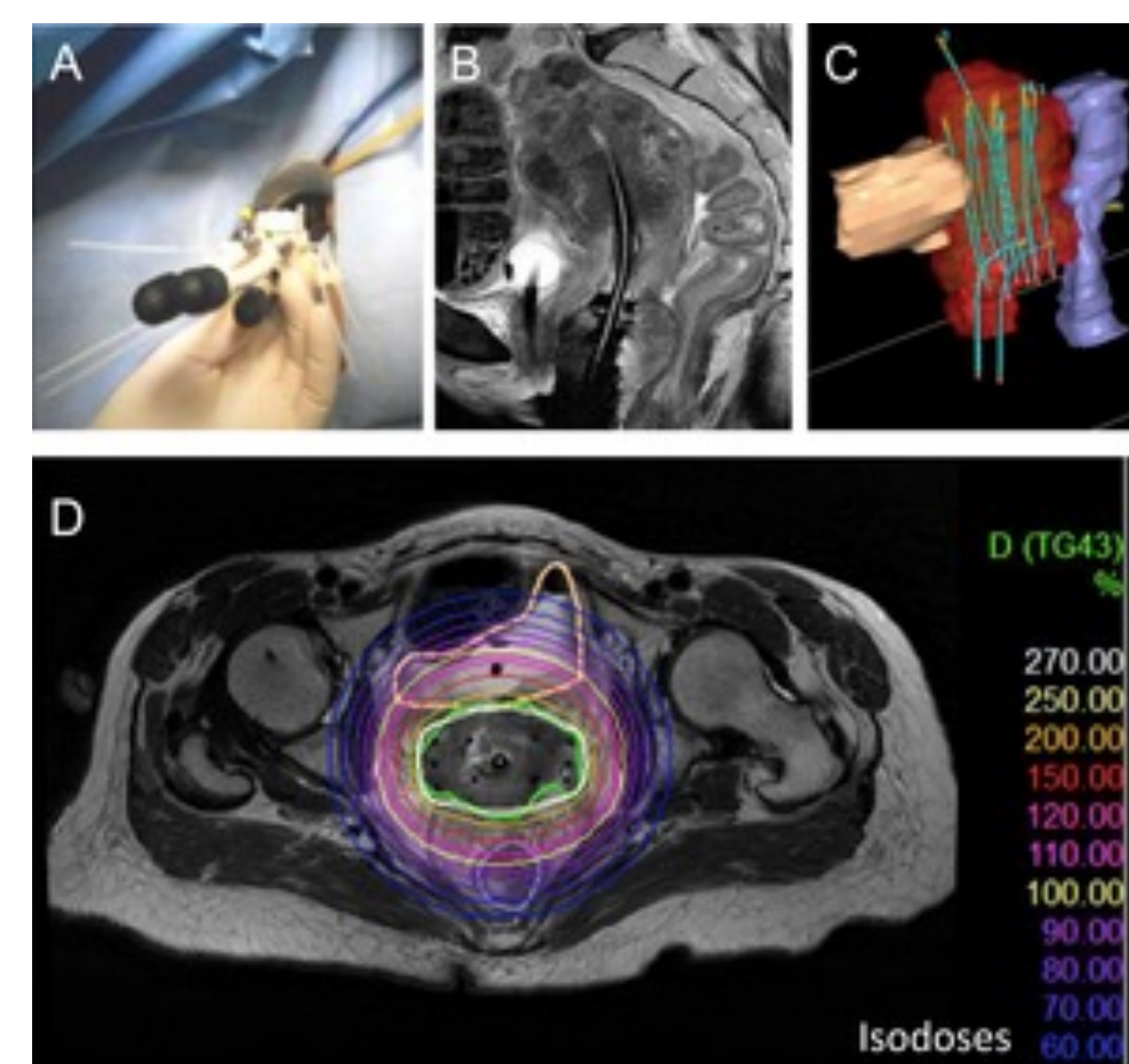


Figure 1. Successful steps in HDR cylinder treatment. (A) Implantation procedure, (B) Image acquisition, (C) Plan for 3D catheter and organs at risk, (D) Treatment delivery (Chargari et al., 2019).

HDR Cylinder Treatment for Endometrial Cancer

HDR Cylinder Treatment is a common treatment for endometrial cancer that aims to reduce the risk of local recurrence.

It can be delivered alone or in combination with External Beam Radiation Therapy (EBRT) depending on the stage and grade of disease. During treatments, a single-channel cylinder is placed intra-vaginally. An Iridium-192 radioactive source is then positioned inside the applicator at pre-specified locations and times using a remote afterloading brachytherapy system (Paterson, Pearson, & Johnson, 2019).

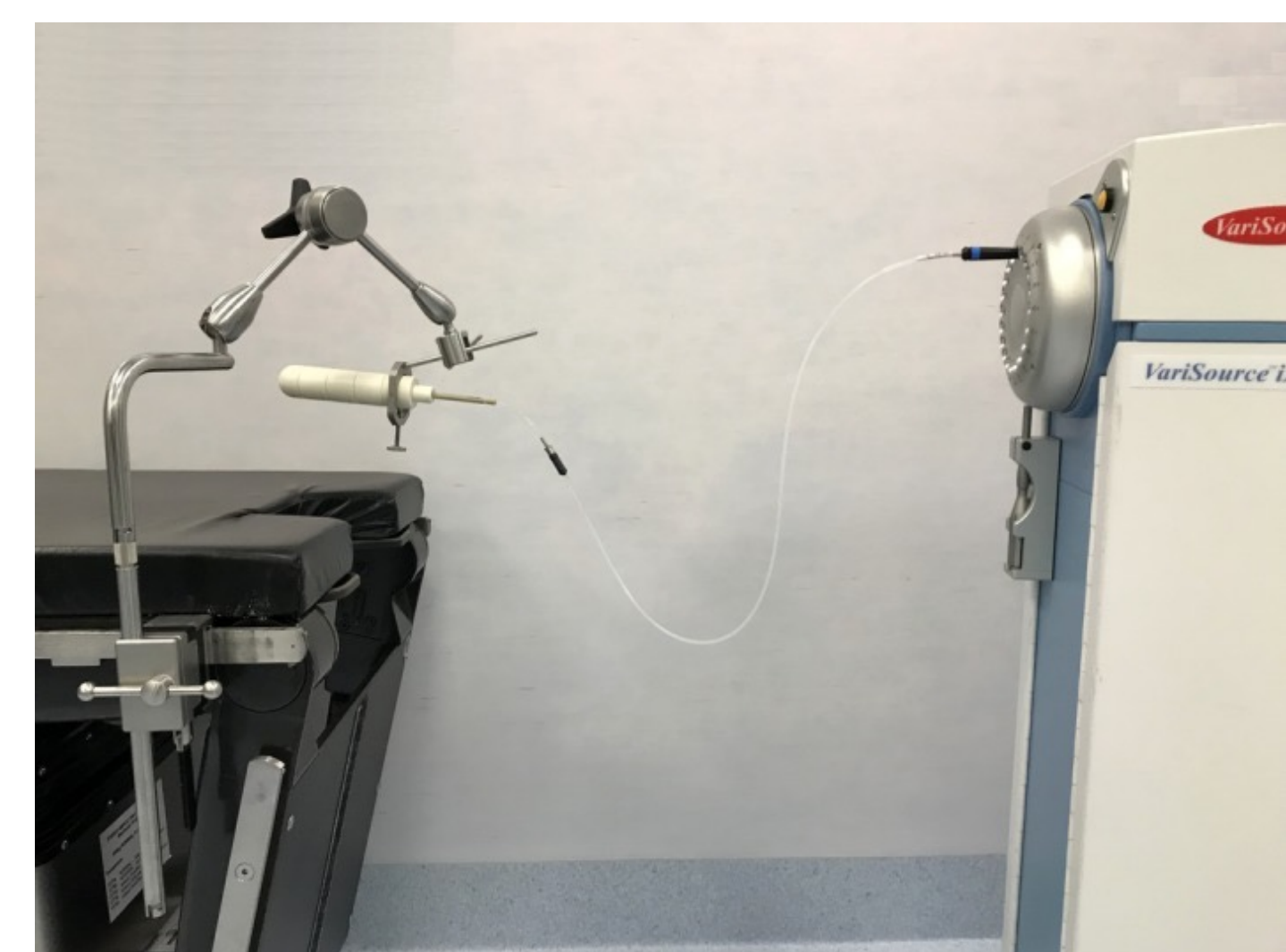


Figure 2. Cylinder applicator connected to HDR brachytherapy remote afterloader (Paterson et al., 2019).

The afterloading device administers the high levels of radiation inside the patient's vaginal canal by being directed remotely through a connecting catheter, present within the cylinder applicator. The radioisotope source that travels through the catheter is precisely delivered to the tumor of interest. Once completely delivered, the sources are retracted back into the remote afterloader (Paterson et al., 2019).

Role of Radiation Therapists

In the past, HDR Cylinder Treatment was performed almost entirely by the radiation oncologist. In more recent years, radiation therapists have been taking over these responsibilities (Paterson et al., 2019).

A recent study explored if radiographer-led delivery of HDR Cylinder Treatment was safe and effective. The five-year recurrence rate from those treated by radiation therapists was only 2.3%, which was extremely low. Thus, this study strongly supported that radiation therapists can safely and effectively lead this procedure (Buckley, Bradshaw, Gregory, & Prewett, 2019).

Time of Treatment

Treatment is typically divided into two to four fractions. The total treatment time is usually less than an hour, with radiation only being administered for 10-20 minutes each fraction (Paterson et al., 2019).

Side Effects for Patients

Unfortunately, HDR Cylinder Treatment has the risk of impairing vaginal mucosa, which can cause vaginal stenosis and fibrosis. The most common reported side effects have been sexual dysfunction, vaginal dryness, and vaginal atrophy (Wierzbicka et al., 2021).

Available Interventions for Side Effects

Intervention with hyaluronic acid, along with vitamin A and vitamin E, revealed advantage in reducing vaginal mucosal inflammation, vaginal dryness, bleeding, fibrosis, and vaginal atrophy (Wierzbicka et al., 2021).

In a study where patients were treated with a full, distended bladder, there were reduced doses of radiation to the small bowel and other surrounding organs. Thus, requiring patients to be treated with a full bladder reduces negative side effects (Buzón et al., 2021).

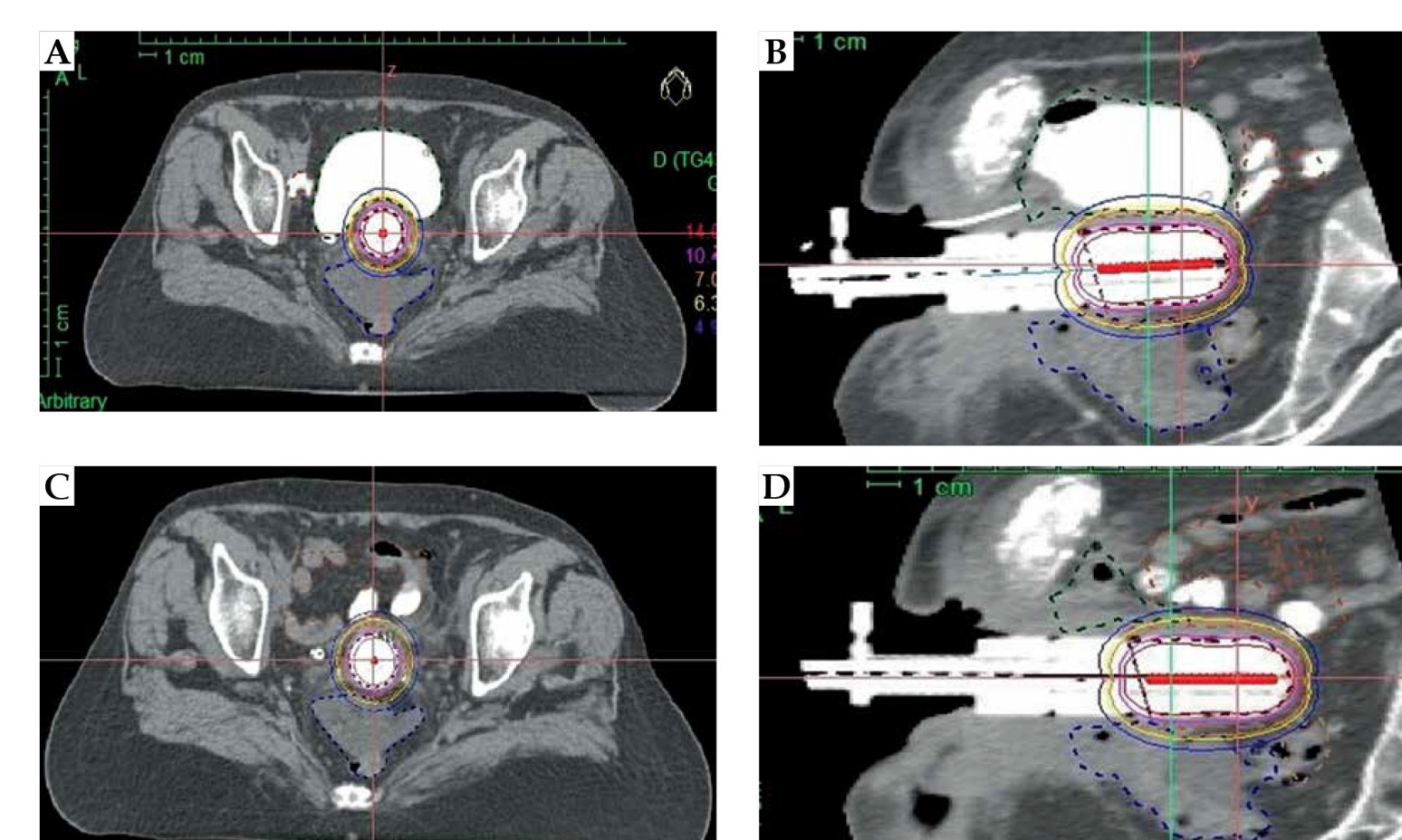


Figure 3. (A) Sagittal view with full bladder, (B) Resultant small bowel displaced, (C) Sagittal view with empty bladder, (D) Resultant small bowel loops very close to cylinder (Buzón et al., 2021).

Overall Results of HDR Cylinder Treatment

HDR Cylinder Treatment has proven to be an extremely effective treatment in reducing local recurrence rates of endometrial cancer. It is now possible to keep the absolute probability of severe rectal, bladder, or small bowel complications below 5% (Chargari et al., 2019).

Other treatments for Endometrial Cancer

External Beam Radiation Therapy (EBRT) can be used as a form of endometrial cancer treatment. In a recent study, EBRT decreased pelvic recurrence rates compared with HDR Cylinder Treatment alone, but it did not yield survival benefit.

EBRT has shown to be a consequence of bowel and bladder morbidity in patients. This is due to the characteristics of its radiation beam, which allows for the possibility of large volumes directed to the bowel and bladder (Chargari et al., 2019).

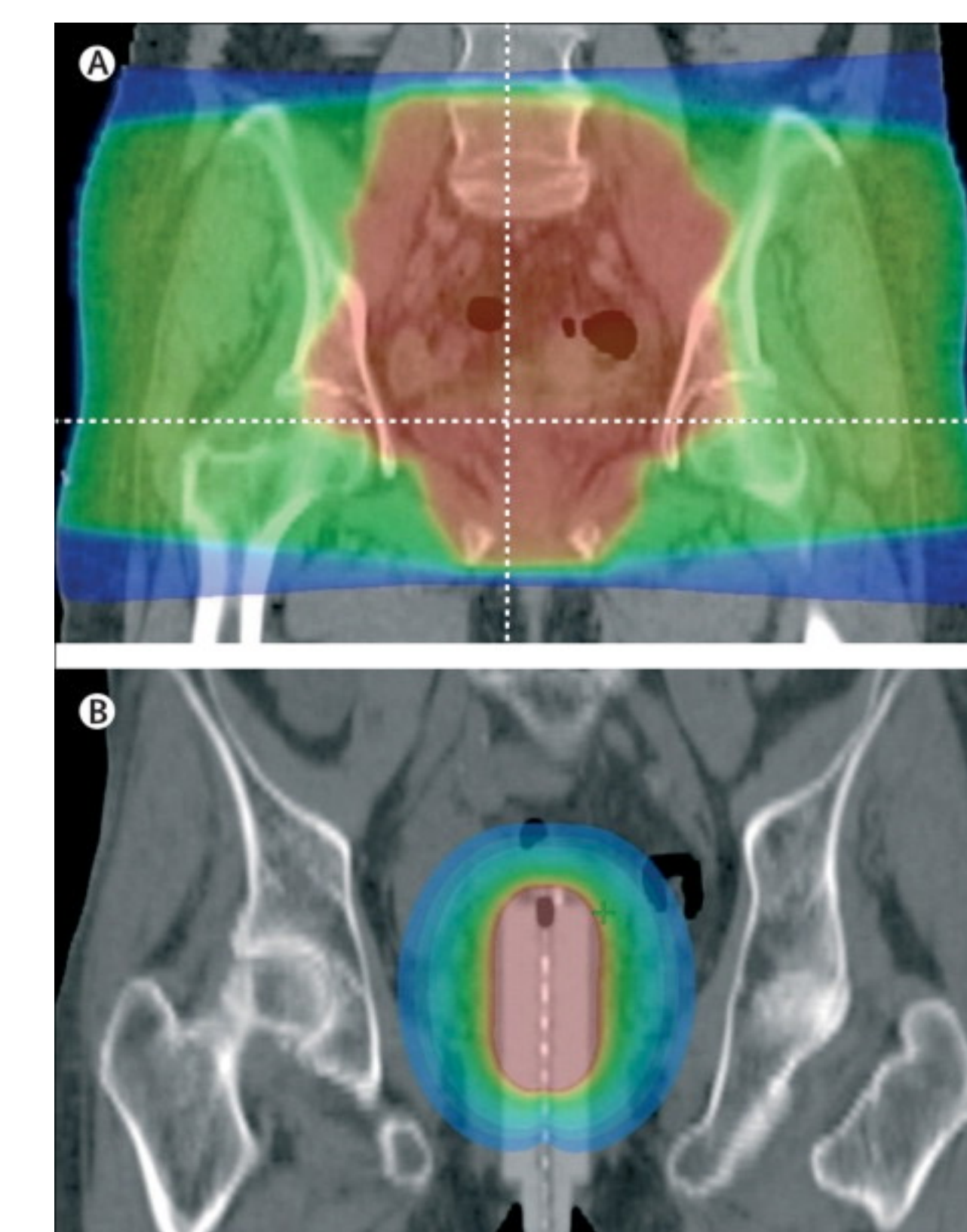


Figure 4. Comparison of dose distribution for EBTR (top) vs HDR Cylinder treatment (bottom). Red represents high dose and blue represents low dose. The dose distribution is better targeted in HDR treatment (Kitchener & Powell, 2019).

Why HDR Cylinder Treatment is Best

HDR Cylinder Treatment is far superior in treating more advanced stages of cancer. It also is the most recommended treatment for endometrial cancer due to it not posing a high risk for bowel or bladder morbidity, which EBRT does. Since HDR Cylinder Treatment is so refined, it allows safe delivery of high doses of radiation without allowing radiation doses to the rectum, bladder, sigmoid, or bowel. There is no need for additional uncertainty margins around the clinical target volume because if the tumor moves, the radiation source moves as well.

Treatment can be delivered within a few days, compared to many days over many fractions. Consequently, the decrease in overall treatment time improves local control by limiting tumor repopulation (Chargari et al., 2019).