Research Article

The European Journal of Cancer

Proposal for Radiotherapy Dose Constraint Predicting Uterus Fertility Sparing: A Successful Pregnancy Case Report Following Curative Chemoradiotherapy for Rectal.

Lohynska R[1*], Jirkovska M

***Corresponding author**

Lohynska Radka,
Department of Oncology, First Faculty of Medicine of Charles University.

Received Date : June 03, 2024
Accepted Date : June 05, 2024
Published Date : July 05, 2024

ABSTRACT

Curative sphincter sparing radiation is a treatment option for early rectal cancer patients who do not qualify for drastic surgery.

There have been several treatments explored to preserve fertility in young patients.

Radiation dose to the ovaries and uterus determines pregnancy rates following pelvic radiotherapy.

In 2003, a 32-year-old female had 58.6 Gy of irradiation for anorectal adenocarcinoma T2 N0 M0, followed by curative chemoradiotherapy. The overall average dose to the uterus was 16 Gy, and 35 Gy To the uterine cervix. Prior to receiving radiotherapy, the patient underwent laparoscopic lateral cranial ovarian transposition. Despite unsuccessful spontaneous pregnancy, the patient had in vitro fertilization with donor eggs and had twins 10 years after radiotherapy treatment. At 38 weeks gestation, she successfully delivered two healthy infants weighing 2420g and 2220g via caesarean surgery we provide a case of full-term twin delivery following curative radiation for anorectal cancer. This is the first account of a successful pregnancy after sphincter sparing curative pelvic surgery.

Radiation to total dose: 58.6 Gy. The average dose to the uterus was 16 Gy, while the uterine cervix received 35 Gy. To accommodate treatment planning constraints, we accepted doses that maintained uterine function throughout pregnancy following pelvic radiation.

Keywords : Rectal adenocarcinoma; Radiotherapy; Dose constraints; Uterus; Fertility sparing

INTRODUCTION

Radiation therapy in young women can have long-term impacts on fertility, depending on age, dose, and place of treatment. Human oocytes are highly susceptible to radiation, and the estimated The median lethal dose (LD50) is less than two Gy [1]. Radiation exposure causes premature ovarian failure. The effectiveness of radiotherapy depends on the patient's age and the average dose of fractionated radiation delivered to the ovary and uterus. The effective sterilizing dose, which causes premature ovarian failure in 97.5% of individuals, diminishes as patients age. The dose is 20.3 Gy at birth, 18.4 Gy at 10 years, 16.5 Gy at 20 years, 14.3 Gy at 30 years, and only 6 Gy for women over 40 years old [2].

After pelvic radiation, women are more likely to experience early ovarian failure and uterine malfunction, which can lead to miscarriages, placental abnormalities, and preterm labor. and low birth weight. Uterine growth typically ends around the age of 20 [3]. Radiation exposure to the uterus causes decreased vascularity, fibrotic alterations in the myometrium, and hormone-dependent endometrial insufficiency, resulting in smaller uterine volumes and atrophic endometrium, negatively impacting reproductive results. In adults, exposing the uterus to 12-14 Gy can cause substantial uterine damage. Childhood exposure to uterine dosages above 25 Gy causes irreparable harm [4]. Within one year following radiotherapy, there is a higher risk of infertility, miscarriage, premature labor, intrauterine growth retardation, and low birth weight [5,6]. Several authors suggest that patients There is a lack of clarity regarding the radiation dose to the uterus, which would render a pregnancy unsustainable. The literature provides proof of successful pregnancies, such as:

A study found that IVF assisted conception and full-term birth occurred 14 years after high-dose chemotherapy and 54 Gy of pelvic irradiation for Ewing's sarcoma (the uterine dose was not stated) [8]. This is the first account of full-term twin delivery after anorectal cancer was successfully treated with radiotherapy.

The European Journal of Cancer

CASE PRESENTATION

A 32-year-old female with no comorbidities chose curative sphincter sparing radiation versus radical abdominoperineal resection for distal rectal cancer T2 N0 M0. She underwent a laparoscopic lateral cranial ovarian transposition 14 days prior radiotherapy. Radiotherapy was administered in prone position with an empty bladder using a 3D conformal radiotherapy approach. The patient had 48, 6 Gy of external beam radiation in 27 segments, along with continuous 5-fluorouracil chemotherapy and a 10 Gy interstitial anal canal brachytherapy boost (total tumor dose: 58, 6 Gy). The average overall dose to the uterus was 16 Gy, with 35 Gy to the uterine cervix.

The dose to transposed ovaries was assessed at 10-12 Gy because to the lack of contrast markings.

DISCUSSION

Radiation exposure to female reproductive systems is a significant toxicity issue, causing over 50% of cervical cancer, 10% of anal cancer, 5% of colorectal cancer, and 2% of uterine or bladder cancer.

Soft tissue sarcomas are more common among women with reproductive capacity. Pelvic radiation is frequently the preferred therapy option for these situations [7]. Despite a modest number of reported successful instances, published data on fertility outcomes following pelvic radiation can help identify factors that affect fertility preservation.

Various fertility preservation treatments have been developed for these instances, including ovarian translocation, gonadal radiation shielding, embryo and oocyte cryopreservation, and GnRH analogues or antagonists may be used to inhibit ovarian tissue, donation oocytes, or gestational surrogacy. Uterine radiation doses of less than 4 Gy appear to have minimal influence on fertility (9). Pre-menarche patients who get uterine radiation are more likely to experience preterm labor. The uterus's radiosensitivity gradually diminishes with age [10]. However, there is a dose-effect relationship between uterine exposure and the risk of low birth weight. At a 0 Gy dosage level, the risk of low birth weight is 7.6%, but increases to 25.5% and 36.2% at higher exposure levels.

According to data on adult Total Body Irradiation (TBI), pregnancy is achievable after 12 Gy TBI, despite higher rates of preterm delivery and difficulties [7]. Furthermore, 14 Gy TBI and bone marrow transplant have been linked to ovarian follicular reduction, reduced fertility, and altered uterine development and flow. 50% of pregnancies end in early loss or preterm labor [11]. Regardless of oestrogen substitution, the typical uterine volume decreases to 40% of its usual adult size [12]. In a research 12 years after a bone marrow transplant, female TBI recipients had a higher incidence of spontaneous abortion (37% vs. 7%) and premature birth (63% vs. 18%) for low birth weight children.

A 25-year-old lady successfully became pregnant after having 30 Gy of pelvic chemo-radiotherapy for anal cancer [16]. A successful pregnancy using a donor oocyte program was reported 15 years following irradiation.

Hodgkin's disease affects the right hemipelvis. The pelvic dose was 36 Gy, and the age of irradiation was 16 [17]. A 14-year-old patient irradiated for Ewing sarcoma received 54 Gy and 10 Gy to the left and right hemipelvis, respectively, and was able to conceive and carry the pregnancy to term [18].

CONCLUSION

Pelvic radiation can be used to treat rectal cancer while preserving fertility. There is no clear dose-effect association for uterine functional failure. However, data from Total body irradiation at 14 Gy is safe during pregnancy. The uterus is similar to other glandular organs, such as the parotid gland, and some authors recommend limiting the absorbed dose to no more than 20-25 Gy 10. However, there is no widely accepted uterine dose constraint, and there are no published cases of successful pregnancies in rectal cancer radiotherapy with precisely defined dose. Our findings indicate that a full-term twin pregnancy can be achieved with a mean uterine dose of 16 Gy and a mean cervical dose of 35 Gy.were suitable for a full-term twin pregnancy and birth. The average dose may limit the ability to sustain uterine function during pregnancy following radiation. Addressing the challenges of fertility-sparing techniques in pelvic radiation patients highlights the need of treatment planning in multidisciplinary oncological teams.

More research is needed to assess the relationship between uterine dose dependency and fertility following pelvic radiation.

REFERENCES

1. Mahajan N. Fertility Preservation in Female Cancer Patients: An Overview. J Hum Reprod Sci. 2015; 8: 3–13.

2. Wallace WH, Thomson AB, Saran F, and Kelsey TW. Predicting Age of Ovarian Failure fter Radiation to a Field that Includes the Ovaries. Int J Radiat Oncol Biol Phys. 2005; 62: 738–744.

3. Lushbaugh CC and Casarett GW. The Effects of Gonadal Irradiation in Clinical Radiation Therapy: A Review. Cancer. 1976; 37: 1111–1125.

4. Larsen EC, Muller J, Schmiegelow K, Rechnitzer C and Anderson AN. Reduced ovarian function in long-term survivors of radiation-and chemotherapy treated childhood cancer. J Clin Endocrinol Metab. 2003; 88: 5307–5314.

5. Chemaitilly W, Mertens AC, Mitby P, Whitton J, Stovall M and Yasui Y, et al. Acute Ovarian Failure in the Childhood Cancer Survivor Study. J Clin Endocrinol Metab. 2006; 91: 1723–1728.

6. Kase KR, Svensson GK and Chen DTS. Radial Distribution of Scattered and Leakage Radiation Dose for Radiotherapeutic Equipment. IAEA-SM-249/25.

7. Teh WT, Stern C, Chander S and Hickey M. The Impact of Uterine Radiation on Subsequent Fertility and Pregnancy outcomes. Biomed Res Int. 2014; 2014: 482968.

8. Rodriguez-Wallberg KA, Karlström PO, Rezapour M, Castellanos E, Hreinsson J and Rasmussen C, et al. Full-term newborn after repeated ovarian tissue transplants in a patient treated for Ewing sarcoma by sterilizing pelvic irradiation and chemotherapy. Acta Obstet Gynecol Scand. 2015; 94: 324-328.

9. Sudour H, Chastagner P, Claude L, Klein M, Carrie C and Bemier V, et al. Fertility and Pregnancy Outcome after Abdominal Irradiation that Included or Excluded the Pelvis in Childhood Tumor Survivors, International Journal of Radiation Oncology Biology Physics. 2010; 76: 867–873.

10. Ghadjar P, Budach V, Kohler C, Jantke A and Marnitz S. Modern Radiation Therapy and Potential Fertility Preservation Strategies in Patients with Cervical Cancer Undergoing Chemo Radiation. Radiat Oncol. 2015; 10: 50.

11. Sanders JE, Hawley J, Levy W, Gooley T, Buckner CD and Doney K, et al. Pregnancies Following High Dose Cyclophosphamide with or without HighDose Busulfan or Total Body Irradiation and Bone Marrow Transplantation Blood. 1996; 87: 3045–3052.

12. Holm K, Nysom K, Brocks V, Hertz H, Jacobsen N and Muller J. Ultrasound B-mode changes in the uterus and ovaries and Doppler changes in the uterus after total body irradiation and allogeneic bone marrow transplantation in childhood Bone Marrow Transplantation. 1999; 23: 259–263.

13. Larson EC, Loft A, Holm K, Muller J, Brocks V and Nyboe Andersen A. Oocyte donation in women cured of cancer with bone marrow transplantation including total body irradiation in adolescence Human Reproduction. 2000; 15: 1505–1508.

14. Critchley HOD, Bath LE and Wallace WHB. Radiation damage to the uterus — Review of the effects of treatment of childhood cancer,Human Fertility. 2002; 5: 61-66.

15. Critchley HOD, Wallace WHB, Shalet SM, Mamtora H, Higginson J and Anderson DC. Abdominal irradiation in childhood; the potential for pregnancy British Journal of Obstetrics and Gynaecology. 1992; 99: 392–394.

16. Hurmuz P, Sebag-Montefiore D, Byrne P and Cooper R. "Successful spontaneous pregnancy after pelvic chemoradiotherapy for anal cancer," Clinical Oncology. 2012; 24: 452–458.

17. de Menezes E and Tuck S.: "Pelvic radiotherapy damage to the endometrium causing morbid adherence of placenta. A new risk factor?" Journal of Obstetrics & Gynaecology. 2007; 27: 526–527.

18. Bath LE, Tydeman G, Critchley HOD, Anderson RA, Baird DT and Wallace WHB. "Spontaneous conception in a young woman who had ovarian cortical tissue cryopreserved before chemotherapy and radiotherapy for a Ewing's sarcoma of the pelvis: Case Report. 2004; 19: 2569-2572.