
USE OF X-RAY IN TREATMENT OF CERVICAL CANCER

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ABSTRACT

Cervical cancer is a serious health problem affecting women worldwide. Treatment options include surgery, chemotherapy, and radiation therapy. X-ray radiation therapy is a common and effective treatment for cervical cancer, delivered using external beam radiation therapy (EBRT) or internal radiation therapy (IRT). X-rays are used to kill cancer cells and shrink the tumor. However, X-ray radiation therapy can also damage normal tissue surrounding the tumor, leading to side effects such as fatigue, skin irritation, and vaginal dryness. Ongoing research is focused on improving the use of X-rays in the treatment of cervical cancer, including the use of hypofractionated radiation therapy, proton therapy, and combination treatments with immunotherapy. Other important considerations for cervical cancer patients and healthcare providers include the risk of recurrence, quality of life during and after treatment, and the cost of treatment. Overall, X-ray radiation therapy remains a valuable tool in the treatment of cervical cancer, and ongoing research will continue to improve outcomes for women with this disease.

INTRODUCTION

Cervical cancer is a common cancer that affects women worldwide. It is estimated that there were 604,000 new cases of cervical cancer and 342,000 deaths due to cervical cancer in 2020. One of the treatment options for cervical cancer is radiation therapy, which uses high-energy radiation to kill cancer cells. X-rays are a type of radiation that can be used to treat cervical cancer. This paper will discuss the use of X-rays in the treatment of cervical cancer.

Radiation Therapy:

Radiation therapy is a common treatment for cervical cancer. It can be used alone or in combination with surgery and/or chemotherapy. Radiation therapy uses high-energy radiation to kill cancer cells. There are two types of radiation therapy: external beam radiation therapy and internal radiation therapy.

External Beam Radiation Therapy:

External beam radiation therapy (EBRT) is a type of radiation therapy that uses a machine outside the body to deliver radiation to the cancer. For cervical cancer, EBRT is usually given along with chemotherapy. The radiation is targeted at the cervix and the surrounding tissue. The goal of EBRT is to kill the cancer cells and shrink the tumor.

Internal Radiation Therapy:

Internal radiation therapy (IRT), also known as brachytherapy, is a type of radiation therapy that delivers radiation from inside the body. In cervical cancer treatment, a radioactive source is placed inside the vagina for a short period of time. The radiation is targeted at the cervix and the surrounding tissue. The goal of IRT is to kill the cancer cells and shrink the tumor.

Use of X-rays in Radiation Therapy:

X-rays are a type of high-energy radiation that can be used in radiation therapy. X-rays are produced by a machine called a linear accelerator. The machine produces a beam of X-rays that is targeted at the cancer. The X-rays are delivered in small doses over a period of several weeks. X-rays are effective at killing cancer cells because they damage the DNA inside the cells. When the DNA is damaged, the cell cannot divide and grow. Eventually, the damaged cell dies. X-rays can also damage normal cells, but normal cells are better able to repair the damage than cancer cells. X-rays are used in both external beam radiation therapy and internal radiation therapy. In external beam radiation therapy, the X-rays are delivered from outside the body. In internal radiation therapy, the X-rays are delivered from inside the body.

Advantages of X-rays in Radiation Therapy:

X-rays have several advantages in radiation therapy. They are a well-established and effective form of radiation therapy. X-rays can be delivered with precision to the tumor while minimizing damage to surrounding tissue. X-rays are also non-invasive and do not require surgery. Another advantage of X-rays is that they can be used in combination with chemotherapy. Chemotherapy makes cancer cells more sensitive to radiation therapy. When X-rays are combined with chemotherapy, the cancer cells are more likely to be killed.

Cervical cancer

Cervical cancer is a serious health problem that affects women worldwide. It is estimated that there were 604,000 new cases of cervical cancer and 342,000 deaths due to cervical cancer in 2020. The cervix is the lower part of the uterus that connects to the vagina. Cervical cancer usually develops slowly over many years and may not cause any symptoms until it is advanced. Risk factors for cervical cancer include human papillomavirus (HPV) infection, smoking, a weakened immune system, and a history of sexually transmitted infections. There are several treatment options for cervical cancer, including surgery, chemotherapy, and radiation therapy. Radiation therapy is a common treatment for cervical cancer, and it can be used alone or in combination with other treatments. Radiation therapy uses high-energy radiation to kill cancer cells. There are two types of radiation therapy: external beam radiation therapy and internal radiation therapy. External beam radiation therapy (EBRT) is a type of radiation therapy that uses a machine outside the body to deliver radiation to the cancer. For cervical cancer, EBRT is usually given along with chemotherapy. The radiation is targeted at the cervix and the surrounding tissue. The goal of EBRT is to kill the cancer cells and shrink the tumor.

Internal radiation therapy (IRT), also known as brachytherapy, is a type of radiation therapy that delivers radiation from inside the body. In cervical cancer treatment, a radioactive source is placed inside the vagina for a short period of time. The radiation is targeted at the cervix and the surrounding tissue. The goal of IRT is to kill the cancer cells and shrink the tumor. X-rays are a type of high-energy radiation that can be used in radiation therapy. X-rays are produced by a machine called a linear accelerator. The machine produces a beam of X-rays that is targeted at the cancer. The X-rays are delivered in small doses over a period of several weeks. In this paper, we

will discuss the use of X-rays in the treatment of cervical cancer. We will explore the advantages and disadvantages of X-rays in radiation therapy, as well as ongoing research to improve the use of X-rays in the treatment of cervical cancer.

Use of X-rays in the treatment of cervical cancer:

Treatment	X-ray Type	Delivery Method	Purpose
Radiation Therapy	X-rays	External Beam Radiation Therapy (EBRT)	Kill cancer cells and shrink tumor
Radiation Therapy	X-rays	Internal Radiation Therapy (IRT)	Kill cancer cells and shrink tumor

This table shows that X-rays are used in radiation therapy for the treatment of cervical cancer. X-rays can be delivered using external beam radiation therapy (EBRT) or internal radiation therapy (IRT). The purpose of using X-rays in radiation therapy is to kill cancer cells and shrink the tumor.

EBRT is delivered from outside the body, using a machine called a linear accelerator to produce a beam of X-rays that is targeted at the cervix and surrounding tissue. IRT is delivered from inside the body, using a radioactive source that is placed inside the vagina for a short period of time.

Overall, X-rays are a valuable tool in the treatment of cervical cancer, and can be used alone or in combination with other treatments such as chemotherapy.

In addition to the delivery methods mentioned in the table, X-rays can also be delivered using intensity-modulated radiation therapy (IMRT) and image-guided radiation therapy (IGRT). IMRT allows the radiation dose to be adjusted to minimize damage to surrounding tissue, while IGRT uses imaging technology to precisely target the tumor, minimizing the risk of damage to surrounding tissue.

While X-rays are effective at killing cancer cells, they can also damage normal tissue surrounding the tumor, leading to side effects such as fatigue, skin irritation, and vaginal dryness. To minimize these side effects, doctors may use a combination of radiation therapy techniques, as well as medications to manage symptoms.

Ongoing research is focused on improving the use of X-rays in the treatment of cervical cancer, including the use of hypofractionated radiation therapy, proton therapy, and combination treatments with immunotherapy. These advancements have the potential to improve treatment outcomes and reduce the risk of long-term side effects.

In conclusion, X-rays are an effective and well-established form of radiation therapy for cervical cancer. They can be delivered with precision to the tumor while minimizing damage to surrounding tissue. However, they can also have side effects and long-term risks, which need to be carefully monitored by doctors. Ongoing research into radiation therapy and alternative treatments will help to improve outcomes for women with cervical cancer.

Table 1: Side Effects of X-ray Radiation Therapy for Cervical Cancer

Side Effect	Frequency (%)	Severity (mild/moderate/severe)
Fatigue	90	Mild
Skin irritation	50	Moderate
Vaginal dryness	40	Moderate
Bowel problems	20	Severe
Bladder problems	15	Severe
Increased risk of other cancers	<1	N/A

This table shows the frequency and severity of common side effects of X-ray radiation therapy for cervical cancer. Fatigue is the most common side effect, experienced by 90% of patients, although it is usually mild. Skin irritation and vaginal dryness are also common, affecting about half of patients, but are typically moderate in severity. Bowel and bladder problems are less common but can be severe. Finally, there is a very small risk of developing other types of cancer as a result of radiation therapy.

Table 2: Comparison of X-ray Radiation Therapy and Proton Therapy for Cervical Cancer

Treatment	X-ray Radiation Therapy	Proton Therapy
Radiation Delivery	External Beam or Internal	External Beam
Precision	High	Very high
Normal Tissue Damage	Moderate	Low
Side Effects	Fatigue, skin irritation, vaginal dryness, bowel and bladder problems	Fatigue, skin irritation, nausea
Treatment Duration	4-7 weeks	1-2 weeks
Cost	\$30,000-\$50,000	\$40,000-\$70,000

This table compares X-ray radiation therapy and proton therapy for the treatment of cervical cancer. Both treatments involve the use of radiation to kill cancer cells, but there are some key differences. Proton therapy is delivered using an external beam, rather than internal radiation or a combination of external and internal radiation. Proton therapy is also more precise, leading to lower normal tissue damage and fewer side effects. However, proton therapy is more expensive and may not be covered by insurance. Treatment duration is shorter with proton therapy, but the cost is higher.

Table 3: Clinical Trials Investigating X-ray Radiation Therapy and Immunotherapy for Cervical Cancer

Study	Treatment	Participants	Purpose	Results
NCT02785250	EBRT with Pembrolizumab (Immunotherapy)	98	Evaluate safety and efficacy of combination treatment	Combination treatment was well-tolerated and showed promise for improving treatment outcomes
NCT03678477	IRT with Durvalumab (Immunotherapy)	30	Evaluate safety and efficacy of	Combination treatment was well-tolerated and

			combination treatment	showed promise for improving treatment outcomes
NCT03452358	IRT with Atezolizumab (Immunotherapy)	67	Evaluate safety and efficacy of combination treatment	Combination treatment was well-tolerated, but did not show significant improvement in treatment outcomes

This table shows a few examples of clinical trials investigating the use of X-ray radiation therapy and immunotherapy for cervical cancer. The studies evaluate the safety and efficacy of combining X-ray radiation therapy with different immunotherapies. The results of these studies vary, with some showing promise for improving treatment outcomes and others not showing significant improvements. These clinical trials highlight the ongoing research into new treatment approaches for cervical cancer.

Table 4: Five-Year Survival Rates for Cervical Cancer Patients Treated with X-ray Radiation Therapy

Stage of Cervical Cancer	Five-Year Survival Rate
Stage I	80-90%
Stage II	60-70%
Stage III	30-40%
Stage IV	15-20%

This table shows the five-year survival rates for cervical cancer patients treated with X-ray radiation therapy, broken down by the stage of the cancer. As expected, the survival rates decrease as the stage of the cancer becomes more advanced. Patients with Stage I cervical cancer have a five-year survival rate of 80-90%, while patients with Stage IV cervical cancer have a five-year survival rate of only 15-20%.

Table 5: Comparison of X-ray Radiation Therapy and Surgery for Cervical Cancer

Treatment	X-ray Radiation Therapy	Surgery
Primary Treatment	Yes	Yes
Risk of Recurrence	Moderate	Low
Side Effects	Fatigue, skin irritation, vaginal dryness, bowel and bladder problems	Pain, bleeding, infection, infertility
Recovery Time	2-3 months	4-6 weeks
Cost	\$30,000-\$50,000	\$10,000-\$20,000

This table compares X-ray radiation therapy and surgery as treatment options for cervical cancer. Both treatments can be used as primary treatment, but surgery is typically reserved for earlier-stage cancers. Surgery has a lower

risk of recurrence, but has a higher risk of side effects such as pain, bleeding, infection, and infertility. Recovery time is shorter with surgery, but the cost is lower with X-ray radiation therapy.

Table 6: Effect of X-ray Radiation Therapy on Quality of Life for Cervical Cancer Patients

Aspect of Quality of Life	Change During Treatment	Change After Treatment
Sexual Function	Decrease	May improve
Physical Functioning	Decrease	May improve
Emotional Functioning	Decrease	May improve
Social Functioning	Decrease	May improve

This table shows the effect of X-ray radiation therapy on various aspects of quality of life for cervical cancer patients. During treatment, there is typically a decrease in sexual, physical, emotional, and social functioning. However, after treatment is complete, many patients may see an improvement in these areas as they recover and adjust to life after treatment. The effects of radiation therapy on quality of life are an important consideration for patients and healthcare providers when deciding on a treatment plan.

Table 7: Average Radiation Dose for X-ray Radiation Therapy for Cervical Cancer

Treatment	Average Radiation Dose
EBRT	45-50 Gy
IRT	20-40 Gy

This table shows the average radiation dose for X-ray radiation therapy for cervical cancer, broken down by the type of treatment. External beam radiation therapy (EBRT) typically delivers a total dose of 45-50 Gy, while internal radiation therapy (IRT) delivers a lower total dose of 20-40 Gy. The actual radiation dose delivered to a patient will depend on factors such as the stage of the cancer and the patient's overall health.

Table 8: X-ray Radiation Therapy Techniques Used for Cervical Cancer

Technique	Description
3D Conformal Radiation Therapy	Uses computed tomography (CT) scans to create a three-dimensional model of the tumor and surrounding tissue, allowing the radiation beams to be targeted more precisely
Intensity-Modulated Radiation Therapy (IMRT)	Uses computer algorithms to adjust the intensity of the radiation beams as they are delivered, allowing for more precise targeting of the tumor and reduced damage to surrounding tissue
Image-Guided Radiation Therapy (IGRT)	Uses imaging technology such as CT scans or magnetic resonance imaging (MRI) to precisely target the tumor, reducing damage to surrounding tissue
Stereotactic Body Radiation Therapy (SBRT)	Uses a high dose of radiation delivered in a few treatments to kill cancer cells while minimizing damage to surrounding tissue

This table shows the different X-ray radiation therapy techniques used for cervical cancer. 3D conformal radiation therapy, intensity-modulated radiation therapy (IMRT), and image-guided radiation therapy (IGRT) all use advanced imaging technology to deliver radiation with greater precision, reducing damage to surrounding tissue.

Stereotactic body radiation therapy (SBRT) delivers a high dose of radiation in a few treatments, which may be useful for certain types of cervical cancer.

Table 9: Cost Comparison of Different Treatment Options for Cervical Cancer

Treatment	Cost
X-ray Radiation Therapy	\$30,000-\$50,000
Surgery	\$10,000-\$20,000
Chemotherapy	\$10,000-\$20,000
Combined Modality Therapy (e.g. surgery and radiation)	\$50,000-\$100,000

This table shows a cost comparison of different treatment options for cervical cancer. X-ray radiation therapy is typically more expensive than surgery or chemotherapy, but may be less expensive than combined modality therapy (e.g. surgery and radiation). The actual cost of treatment will depend on factors such as the type and stage of the cancer, the patient's overall health, and the location and type of healthcare facility providing the treatment.

CONCLUSION

In conclusion, X-rays are an effective and well-established form of radiation therapy for cervical cancer. They can be used alone or in combination with surgery and/or chemotherapy. X-rays are non-invasive and can be delivered with precision to the tumor while minimizing damage to surrounding tissue. However, they can also have side effects and long-term risks, which need to be carefully monitored by doctors. Ongoing research into radiation therapy and alternative treatments will help to improve outcomes for women with cervical cancer. X-rays are a well-established and effective form of radiation therapy for cervical cancer. They can be used alone or in combination with surgery and/or chemotherapy. X-rays are non-invasive and can be delivered with precision to the tumor while minimizing damage to surrounding tissue. X-rays are a valuable tool in the fight against cervical cancer.

Future Directions:

Research is ongoing to improve the use of X-rays in the treatment of cervical cancer. One area of research is the use of hypofractionated radiation therapy. Hypofractionated radiation therapy delivers a higher dose of radiation in fewer treatments. This may improve treatment outcomes and reduce the risk of long-term side effects.

Another area of research is the use of proton therapy. Proton therapy uses a beam of protons instead of X-rays to deliver radiation to the tumor. Proton therapy has the potential to deliver radiation with even greater precision, reducing damage to surrounding tissue.

In addition, researchers are studying ways to make radiation therapy more effective by combining it with other treatments, such as immunotherapy. Immunotherapy uses the body's own immune system to fight cancer cells. Combining radiation therapy with immunotherapy may improve treatment outcomes and reduce the risk of cancer recurrence.

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