External Neutron Beam Radiation Therapy for Cancer

Neutron radiation is a form of high-linear energy transfer (LET) that damages cancerous cells primarily by nuclear interactions. The most widely used application of neutron radiation therapy is for advanced salivary gland cancer. In the United States, only one center, the University of Washington Medical Cyclotron Facility, uses neutron radiation therapy for patients.

Iodine-124 (124I)-Positron Emission Tomography for Thyroid Cancer Treatment Planning

124I-positron emission tomography (PET) is a functional radioimaging technique that uses the positron-emitting 124I isotope to label and visualize thyroid gland tissue. 124I-PET is intended as an alternative to functional imaging with gamma-emitting iodine-131 (131I) to help oncologists plan treatment and follow-up care of patients with thyroid cancer.

EpiGray (Dosisoft SA) for Confirming In Vivo Radiation Dose Delivery During Radiotherapy

EpiGray is a software application for monitoring the accuracy of external beam radiation therapy (EBRT) delivered with electronic portal imaging device (EPID)-equipped linear accelerators. EpiGray detects discrepancies between delivered and planned treatment doses and alerts radiation oncologists of potential treatment errors.

Tumor Removal in Patients with Neurofibromatosis

Neurofibromatosis (NF) is a common genetic disorder that causes growth or tumors to form on nerves. NF may be caused by inheriting an abnormal gene or by a gene defect that occurs during embryo development (spontaneous gene mutation). NF type 1 (NF1), NF type 2 (NF2), and schwannomatosis are the three major forms of NF that affect at least 100,000 individuals in the United States.

MRIdian Cobalt-60 System (ViewRay, Inc.) for Advanced Radiotherapy Delivery

The MRIdian Cobalt-60 System is an integrated magnetic resonance imaging and cobalt-60 radiotherapy delivery system intended to provide advanced radiation therapy, such as image-guided radiation therapy and stereotactic body radiation therapy. Incorporating MRI into the treatment delivery process may improve pretreatment planning and provide better positioning and tracking of tumors during treatment.

SpaceOAR System (Augmenix, Inc.) Hydrogel Spacer for Reducing Exposure During Prostate Cancer Radiation Therapy

The SpaceOAR™ System is a single-use device consisting of a polyethylene glycol powder, buffer solution, and specialized tools for mixing and implantation. The mixture forms a synthetic hydrogel spacer intended to protect the anterior rectum during prostate irradiation by temporarily pushing the rectum away from the prostate. The radiation oncologist uses ultrasound to insert the hydrogel mixture between the rectum and the prostate. The hydrogel is absorbed by the patient's body within three months.

Proton Beam Radiation Therapy Systems for Cancer

Proton beam radiation therapy systems in compact configurations cost between $30 million and $40 million to establish, and traditional multroom configurations cost $100 to $200 million or more. Hospitals continue to invest in these systems despite downward trends in third-party payer coverage for common cancers such as prostate cancer due to lack of evidence of benefit over other radiation treatment modalities.
USE OF GONAD SHIELDING FOR PEDIATRIC IMAGING

Overexposure of the gonads to ionizing radiation can cause gonadal dysfunction (infertility or sterility), greatly reducing reproductive potential. Strategies for improving reproductive potential in patients exposed to radiation include cryopreservation of sperm/ova, radiation dose optimization, ovarian transposition, and gonadal shielding.

NANOKNIFE SYSTEM (ANGIODYNAMICS, INC.) FOR TREATING PANCREATIC CANCER

The NanoKnife® System is an ablation system that uses irreversible electroporation (IRE) and is intended for the surgical ablation of soft tissue. IRE uses high-voltage direct current intended to punch permanent holes in cell membranes and cause cell death.

NANOKNIFE SYSTEM (ANGIODYNAMICS, INC.) FOR TREATING LIVER CANCER

The NanoKnife® System uses irreversible electroporation (IRE) and is intended for the surgical ablation of soft tissue. The manufacturer website provides no further information on this system, which may be due to warning letters sent to the company by the U.S. Food and Drug Administration about inappropriate promotion for unlabeled uses.

REAL-TIME RADIATION EXPOSURE MONITORING IN HEALTHCARE WORKERS

Real-time electronic badges do not replace traditional badges because they do not record a permanent radiation exposure record; however, they can be used to help clinicians immediately adjust their behavior (e.g., repositioning themselves) to comply with occupational radiation safety procedures and reduce their exposure.

THERASPHERE® (BTG INTERNATIONAL, INC.) FOR TREATING HEPATOCELLULAR CARCINOMA

TheraSphere® is an interventional radiation oncology device consisting of nonbiodegradable glass microspheres loaded with the radioisotope yttrium-90. It is indicated for radiation therapy (also known as transarterial radioembolization) delivered through a catheter to tumors locally to reduce liver tumor burden or serve as a bridge to surgery or liver transplantation in patients with unresectable hepatocellular carcinoma.

SIR-SPHERES MICROSPHERES (SIRTEX MEDICAL, LTD.) FOR TREATING LIVER METASTASES FROM COLORECTAL CANCER

SIR-Spheres® are therapeutic polymer microspheres containing the radioisotope yttrium-90. SIR-Spheres microspheres are delivered to the tumor locally through a catheter to treat liver metastases arising from colorectal cancer when curative resection of the cancer is not possible. Yttrium-90 has a useful therapeutic life of 7 to 11 days.

STEREOTACTIC BODY RADIATION THERAPY FOR PROSTATE CANCER

Stereotactic body radiation therapy (SBRT) is a cancer treatment approach derived from the techniques of stereotactic radiosurgery used to treat lesions in the brain and spine. It combines multiple finely collimated radiation beams and stereotaxy to deliver a high dose of radiation, usually 1 to 5 fractions. Proposed advantages include minimizing healthy tissue exposure to high-dose radiation, preventing or accounting for organ motion (e.g., breathing), and the millimeter accuracy of the delivered dose.

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