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radiation beams to send highly concentrated radiation directly into the tumor while delivering minimal dosage to surrounding tissues. The dogs experienced good local tumor control, durable pain reduction, high tumor-necrosis rates, and survival times comparable to conventional therapies. While the canine patients still experienced higher than desirable fracture rates, the treatment showed promise. In later work, with more refined dosing techniques and patient selection, the rates of fractures were reduced.

The results were so promising that the team of researchers at the CSU Animal Cancer Center decided to initiate its own studies of stereotactic radiotherapy. According to Stewart Ryan, BVSC, MS, Dip. CVM, the CSU Animal Cancer Center purchased in 2007 the most advanced linear accelerator in the world, the Trilogy© Stereotactic System, produced by Varian Medical Systems, Palo Alto, California. One of only 15–20 Varian Trilogy systems in the United States, the $3 million machine looks like a prop from the Star Trek medical deck, with a sleek gray body and electronics-packed head and arms surrounding an integrated, motorized patient couch. Ryan, a soft-spoken native of Australia, told *The O&P EDGE*, "A unique advantage of this machine is that is has on-board imaging capabilities, including diagnostic-quality kilovoltage peak (kVp) x-ray imaging and a cone-beam CT, as well as mega-voltage radiation for portal radiography used by traditional linear accelerators. The ability to accurately image the patient at each treatment session is key to ensuring correct positioning and safe delivery of the radiation dose." The Trilogy machine can sculpt the radiation beam based on the computer-enhanced, three-dimensional diagnostic images, which means that the Trilogy can work with tumors of almost any size and complexity of shape. Previous-generation machines, such as the Leksell Gamma Knife©, Elekta AB, Stockholm, Sweden, are designed for intracranial tumors and don't efficiently handle tumors of odd sizes and shapes. The Gamma Knife is limited to a treatment area just 3cm across and, according to Ryan, "tends to like a spherical-shaped tumor."

Targeted Dosages

The Trilogy's imaging capabilities are just part of its power. Ryan says, "Its real advantage comes with the treatment planning software. The Varian Trilogy has an 'inverse planning system' that allows us to identify structures within the treatment field. Then we can assign a maximum radiation dose, a range of radiation, or a minimum dose to each structure. The software then…comes up with the optimal algorithm and number of treatment beams to achieve delivery of a maximum dose to the tumor volume and a limited dose to the surrounding normal tissue structures. Once the optimal treatment plan is reviewed, the algorithm and images are integrated into the Trilogy's on-board guidance system. Small adjustments are made with the patient on the couch to perfectly align the patient's tumor with the radiation beams by comparing

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