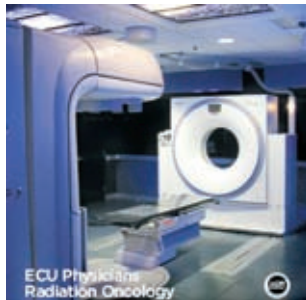




THINKING **OUT** OF THE VAULT

A REASSESSMENT OF THE VAULT IN RADIATION ONCOLOGY **By Ron Allison, M.D.**

VAULT IS A PARTICULARLY APPROPRIATE DESCRIPTION FOR THE CLASSICAL WAY radiation oncology linear accelerators are housed. To save on the costs of shielding for these high-energy radiation treatment devices, units are generally located in the basement or subbasement of hospitals and private offices.



contrast to modern infusion and chemo bays where comfort and space is emphasized, radiation therapy vaults have not improved dramatically. Currently, the one aspect targeted is a ceiling mural for patients to stare at while lying on their back during treatment. While truly an improvement over peeling ceiling paint, this is only a slight enhancement of the therapy process.

The depressing result of dreary location and housing truly is a disservice to the millions of patients annually undergoing radiation therapy for cancer especially since radiation treatment often requires multiple visits — about 40 or so for prostate external beam. In addition, the quality of surroundings may not only be critical from a patient and staff psychological perspective, but in this very competitive medical environment, it may also have significant implication for decisions regarding where patients seek therapy. As in many other medical endeavors, the treatment environment in addition to treatment quality is a critical factor for patients who have a choice where care will be delivered. For those and other reasons, more open, efficient and often stunning architecture is employed to showplace hospitals and treatment facilities.

All too often these building improvements stop at the actual area where radiation treatment is delivered. In

Modern radiation treatment relies on technologically advanced linear accelerators to deliver precise high-energy X-ray beams to destroy malignancy and spare normal tissue. While cleverly engineered, they do not take into account the actual patient experience. This is often multiple daily visits lying on a very hard couch with numerous barbaric-appearing devices employed to minimize patient motion. In fact, for gamma knife therapy screws are placed in the patient's head, which is then bolted to the table. The treatment session may be only a few minutes but during the ever more common delivery of ultra-precise treatment like IMRT or radiosurgery, table time may approach an hour or more. Additionally, the machines require precise electric and temperature control, which generally involves relatively loud chillers, coolers and amperage regulators causing some vaults to sound like an expressway. Lighting is



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Far left: CT on rails with a space theme

Left: Skylight filled treatment corridor

tative was to seal the leaks of this greenhouse in lieu of the planned removal of this architectural gem with replacement by a conventional roof. The next order of business involved upgrading the nearly 20-year-old linacs, which were far too antiquated to offer state-of-the-art radiation therapy. The three vaults located side by side also were untouched since the mid-80s, and the wear and tear was depressing to both patient and staff. Study of the vault's floor plans revealed that each vault had a nearly 50 percent reduction in footprint caused by false walls. The three very tight spaces were extraordinarily large, but because of design they were clinically so cramped that stretchers could not easily be brought into two of the three vaults.

The first vault to be reconstructed is now termed the 'space vault' based on its theme. This 30-foot-by-40-foot space was fully opened to allow for one of the first image

generally harsh as well to ensure the technologists can set up the patient to the appropriate coordinates. With all the custom devices used to immobilize each patient — and there may be 50 patients treated each day on a machine — most vaults resemble scrap yards. Further, as construction costs continue to spiral, the footprints of modern vaults continue to shrink making for even more cramped environs. Overall, this is the standard of radiation therapy vault environment, obviously a situation in need of correction.

Designed in 1985, the radiation oncology vaults at East Carolina University, Brody School of Medicine, Department of Radiation Oncology, were no exception to this depressing standard. However, unlike many radiation departments this one is above ground. Unique to this facility is that the treatment corridor leading to the vaults has a spectacular pyramidal series of skylights taking advantage of the mostly sunny days of North Carolina. When looking to improve the area, the first ini-

guided radiation therapy units in North Carolina. A CT on rails was also among the first installed in the nation. This tool allows for unprecedented imaging quality by the diagnostic CT unit and remains as a state-of-the-art tool even five years after its introduction. The vault itself allows for easy access to both the linac and CT so patients and staff are never overwhelmed by the size of these machines. A combination of stainless steel and black mirrors and wall and ceiling murals help present a transformative space. The flooring has an optical illusion to create a three-dimensional feel as well. As the department treats many children, rather than becoming extraordinarily scared of therapy they are particularly delighted with the feeling of being in a spaceship. Adults also realize they are entering a special room for a type of advanced treatment not routinely offered.

The next vault was upgraded to a Zen atmosphere. This room was transformed in a different fashion. The plate to hold the linac to the floor was originally placed



1: Pre-construction vault with low ceilings and tight quarters
2: Construction allowed opening of rear of vault creating a sense of space
3: Cyberknife vault
4: Post-construction spa-like appearance



in the center of the room, which was awkward both clinically and visually. This placement made it difficult to bring patients into the vault and often the staff had to swing the gantry to move the patient. A false wall behind the linac shortened the room by nearly 50 percent making for an additionally tight space. Due to the excessive cost of relocating the linac's base plate and constraints and to minimize downtime, the replacement linac was again placed in the same position. However, the false wall behind the linac was replaced by a gently curving series of floor-to-ceiling storage units, each backlit and faced by a shoji screen front made of resistant opaque plastic laminate.

The doors of each showcase gently curve to create the egg-like shape. The cabinetry is of the highest quality cherry and was created and fit off-site and installed over a weekend in the actual vault. The entranceway of

this vault was finished with a rich slate. A synthetic bamboo floor was then chosen for strength and beauty. A back-lit scene of cherry blossoms covers the ceiling. Critically important was that the noise generating component of this linac was located behind the rear wall and placed into sound absorbers, creating a quiet Zen-like space, a remarkable underappreciated aspect of this design.

The third vault, which appeared tiny, was refabricated to fit the Accuray Cyberknife. This robotic radiosurgery unit contains two robotic arms, one for the linac, the other for the couch. Unlike standard linacs this unit is nearly 10 feet tall, usually far higher than the design of most vaults. When the false 8-foot ceiling was opened the vault was actually 16 feet high. Further, removing the false walls doubled the usable square footage.

Today, this likely is one of the largest Cyberknife vaults in the world. This vault was designed to be as spectacular as the treatment unit itself. A multicolored floor with a circular inlay, outlining the Cyberknife treatment circle, was created. The standard storage units were fronted by a stunning wall length bay of backlit opaque, horizontally striated glass. The vault entrance and main wall have horizontally generated wall panels with tiger striped wood. This vault is all about high-quality materials blending into a clean, sleek modern feel. The architectural finish of this room allows for a transformation of the massive, overwhelming Cyberknife to a very human scale.

The overall effect is sleek, clean and modern, and patients comment positively on this, in sharp contrast to comments on other Cyberknife units where the actual machine is overwhelming due in large part to the lack of human scale in the treatment vault.

Medical construction has come a remarkably long way to enhance comfort and project quality. Radiation centers for cancer patients are lagging perhaps due to a lack of vision about the impact of the daily visit on patients. The vault should not be the afterthought. It should be given as much consideration as the treatment unit as it reflects on the perceived quality treatment and the consideration of patient needs. ■

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