

EXTENDING CARE

As the world leader in radiotherapy, Varian develops and supplies systems that advance the speed and precision of treatment capabilities for the benefit of cancer patients worldwide.

IN THIS SECTION:

- 08 A Focus on Precision: Advances in radiotherapy
- 10 New Treatment Options: New methods of treating lung and liver
- 11 Equipping the Developing World: Extending care globally
- 12 Meeting the Training Challenge: Educating the practitioners

20

million annual
new cancer cases
globally by 2050

HEALTH ACCESS AND OUTCOMES



There are
more than
200
different types
of cancer

A FOCUS ON PRECISION

The key to successful radiation therapy treatments is precision: with precision, clinicians have the confidence to boost doses and potentially improve outcomes; with precision, surrounding healthy tissue is better spared during treatment, reducing complications; with precision, the dose can concentrate on doing what it does best – killing cancer cells.

Precision in delivering the treatment beam is helped enormously by today's automated tools, integrated treatment software and hardware, and superlative imaging technologies, all of which Varian has pioneered.

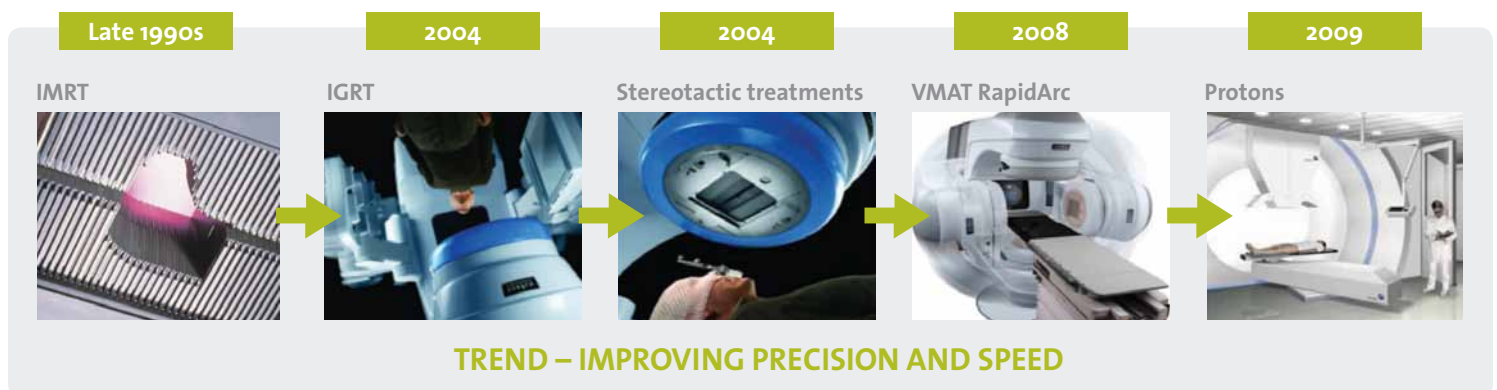
Intensity-modulated radiation therapy (IMRT) is a radiotherapy process that enables clinicians to precisely target the radiation dose at the cancerous tumor while better protecting surrounding healthy tissue, as well as automatically varying the dose strength to target the tumor more effectively. Varian introduced IMRT solutions in the 1990s and the technique has now been introduced in many hundreds of clinics around the world.

With such increased precision in dose delivery, the need for more accurate tumor-tracking images became paramount. In 2004, Image-Guided Radiotherapy (IGRT) became a reality with Varian's introduction of imaging tools such as the On Board Imager.

Most tumors are not stationary: they move within the body either through natural motion or in tandem with the patient's breathing cycle. With increasingly precise treatment delivery capabilities, extreme precision in patient setup for treatment has become even more vital. IGRT enables doctors to locate the tumor while the patient is in the treatment position and to minimize the volume of healthy tissue exposed to radiation during treatment by reducing treatment margins.

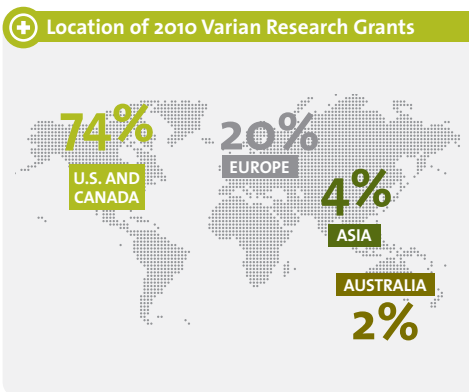
Combining IMRT and IGRT, VMAT (volumetric modulated arc therapy) enables much faster treatments because the treatment machine is in continuous motion around the patient during treatment. Again Varian pioneered VMAT and introduced its first clinical solution with RapidArc in 2008.

Taking precision in beam delivery a step further, stereotactic radiosurgery (one treatment) and stereotactic radiotherapy (more than one treatment) have become a reality. Conventional radiotherapy treatments involve 30–35 daily treatment sessions. With stereotactic treatments, the same dose is delivered in one to ten sessions. This enables radiation oncologists to treat metastases or lesions as they develop away from the primary tumor, as well as giving neurosurgeons an effective tool in the battle against intra-cranial tumors.



By introducing all these techniques on fast and efficient linear accelerator technology, Varian is working with clinics to achieve the dream of turning cancer into a chronic or manageable disease rather than a fatal one. Future innovations are likely to focus on real-time tumor tracking during treatment and combining radiotherapy with chemotherapy, using the beam to trigger localized drug treatments. Blue sky work is also underway to combine radiotherapy with biological agents.

Varian is also investing in proton therapy and is equipping new proton therapy centers in Europe and the U.S. Unlike conventional radiotherapy which uses high-energy X-rays, proton therapy delivers heavy particles – protons – which can be deposited even more precisely with less damage to surrounding healthy tissue. Proton centers are expensive to build and run and they'll never replace X-ray based radiotherapy, but they have a key role to play in treating children and cancers that are very close to critical structures, such as the eye and the spine.



INVESTING IN RADIOTHERAPY RESEARCH

Varian has a proud history of working with development partners to extend the capabilities of radiotherapy globally and in 2010 the company had 115 active research projects worth a total of \$7 million to further this aim.

Scott Johnson, PhD, Varian's senior manager of research collaborations, says, "There's an element of enlightened self-interest in awarding grants, as they help our product development teams to build better products, they demonstrate the clinical and operational effectiveness of these products, and they help grow the number of patients for whom radiotherapy is a viable option.

"The result, however, is the wholly philanthropic idea of improving cancer care by producing the best products for doctors to treat their patients."

Nearly three quarters of the research grants in 2010 were awarded to U.S.-based partners, with about 20% in European hospitals and just over 5% elsewhere. But this ratio will gradually evolve to supporting more international partners in the years ahead.

Varian plans to issue \$9.8 million worth of research grants in 2011 and \$9.8 million in 2012.

"Research grants will increasingly support the company's strategy to focus on stereotactic body radiotherapy (SBRT) for lung and liver treatments, particularly in China. At the same time, we'll increase the proportion of grants that aim to demonstrate the clinical and operational effectiveness of our products."

**Scott Johnson, PhD, senior manager,
research collaborations**



LUNG CANCER – NEW TREATMENT OPTIONS

“We surveyed all our customers who have acquired TrueBeam systems to date and more than 90% of them said they planned to add SBRT to their practice, so this is something that’s really gathering momentum as a non-invasive alternative to surgery.”

 Dow Wilson, chief operating officer

Lung cancer is the biggest cancer killer in the world, causing more deaths than breast and prostate cancer combined. Every 30 seconds, someone somewhere in the world dies of lung cancer. In 2010, there were estimated to be 1,608,055 new cases of lung cancer worldwide and 1,376,579 deaths, representing 18.2% of all cancer deaths. In developing nations, the lung cancer burden is expected to grow exponentially – in China alone, there are predicted to be nearly 750,000 cases of lung cancer in 2020, more than half the global burden.

As well as being increasingly prevalent, lung cancer is hard to treat. While survival rates have improved considerably for most forms of cancer, lung cancer survival rates remain stubbornly low. Surgery is an option only for healthy, operable patients and the traumatic nature of lung cancer surgery, involving incisions from the sternum to the spine, means long recovery periods.

In the past, radiotherapy has primarily had a role to play for pain relief, not for curative intent. But now, with more precise treatment techniques and better imaging to account for motion, stereotactic radiosurgery is a viable alternative to surgery. In effect, doctors can now use the radiotherapy beam to excise the tumor in the same way that a surgeon uses a scalpel, although non-invasively.

SBRT

Over the past few years, stereotactic body radiotherapy (SBRT), which involves delivering the dose in fewer treatment sessions than with conventional radiotherapy, has increasingly been used to treat inoperable lung cancer patients. Clinicians now believe that operable patients could also benefit from such treatments. Numerous trials are underway and outcome data is extremely positive, including results from a study in Texas showing a remarkable 57% three-year survival for frail, elderly, inoperable lung cancer patients.¹

“Conventional radiotherapy is often not acceptable for high-risk patients who may not be willing or able to travel but SBRT, involving far fewer treatment sessions, is an increasingly viable option,” says Professor Suresh Senan, radiation oncology at VU University Medical Center in Amsterdam, where life-saving treatments are delivered using Varian equipment and software.

Varian, with its new TrueBeam device able to deliver dose at more than twice the speed of any other radiotherapy device, is at the forefront of this trend towards higher dose treatments in fewer treatment sessions. “We’re providing clinicians with the tools to offer curative options for difficult-to-treat tumors such as lung and liver, and this is a key part of our mission to help save an additional 100,000 lives,” says Dow Wilson, chief operating officer.

¹ Timmerman R et al. Stereotactic body radiation therapy for Inoperable Early Stage Lung Cancer. JAMA 2010; 303(11): 1070–1076.



The team at Al Kindy Hospital in Casablanca, Morocco, where the first advanced RapidArc IMRT treatments in north Africa have recently taken place.

EQUIPPING THE DEVELOPING WORLD

We live in a world where developed countries like those in North America and Western Europe are pretty well equipped with advanced cancer treatment systems, while developing regions are woefully under-equipped. As part of our mission to help save an additional 100,000 lives a year, Varian's focus has been on bridging this divide and extending advanced care to more people. We achieve that via a number of global initiatives aimed at supplying emerging economies with superior systems while developing techniques that make advanced treatments easier and quicker to deliver.

While North America has 13 modern radiotherapy machines per million population and western European nations have between five and ten per million, emerging countries such as India and China have far fewer than one per million. To get China and India – both of them fast developing nations – to even the lowest number of machines per capita of the western world would require another 20,000 machines to be installed; and there are only 12,000 in the entire world today. Developing countries such as Indonesia, Bangladesh and most African nations lag even further behind.

So this is a huge gap to bridge. But Varian is working with customers and partners to bridge that gap and provide access to modern treatments to some of the world's poorest nations – and innovation such as RapidArc is playing a major role.

FASTER TREATMENTS

When RapidArc was introduced in 2008, it offered a much faster way of delivering advanced IMRT (intensity-modulated radiation therapy) treatments. Although research has shown IMRT is an effective way of focusing dose on the tumor while sparing exposure to surrounding healthy tissue, many hospitals delayed introducing treatments because of the additional expertise and time required to plan and deliver IMRT treatments.

Conventional IMRT involves stopping the machine several times as it rotates around the patient and delivering the beam from many different angles, thus creating a “hot spot” on the tumor while limiting damage to surrounding tissue and organs. This “step and shoot” process is time-consuming and IMRT plans are more complex than standard 3D conformal radiotherapy plans.

With RapidArc, clinicians can achieve the same “hot spot” but they can do it in a single or multiple continuous rotations of the machine. No more stepping and shooting. Treatments that previously took ten to 15 minutes can now be carried out in one to two minutes. Hospitals can treat more patients while offering superior treatment techniques.

Varian has introduced a low-energy treatment machine called UniQue which can include RapidArc for a much reduced price. UniQue can handle 75% of the cancer cases that enter a hospital, but at a cost that's affordable for developing countries. Varian's family of linear accelerators are regarded as reliable, high-throughput systems that enable radiotherapy departments to treat significant numbers of patients with safe, high-quality treatments.

And Varian's X-ray Products group contributes to system efficiency by introducing new families of X-ray tubes and image detectors that enable higher quality diagnostic images to be acquired at a lower dose per image.



+ RapidArc

RapidArc enables advanced image-guided IMRT treatments to be delivered in as little as a minute.



| Bangladesh United Hospital.

“By developing faster and more efficient ways of delivering advanced treatments, we can help emerging countries to not only offer modern techniques for the first time, but to do that without making lengthy waiting lines even longer.”

© Dr. Ayan Basu, M.D.
oncology at United Hospital

BRINGING ADVANCED TREATMENTS TO BANGLADESH

When Varian supplied four modern linear accelerators to two public hospitals in Bangladesh five years ago, it marked a dramatic advance in radiotherapy capabilities for a country of 160 million people. Prior to that landmark event, the entire country had only two linear accelerators, one at a military hospital and one at a private center, and both of them older than ten years.

Today, there are 11 accelerators serving the country’s cancer population, including devices capable of advanced RapidArc IMRT (intensity-modulated radiation therapy) treatments. RapidArc treatments have begun on an advanced Clinac linear accelerator at the new United Hospital Comprehensive Cancer Care Center in the capital, Dhaka.

“As well as offering great precision and excellent dose distribution, RapidArc enables us to deliver the dose more quickly,” says Dr. Ayan Basu, M.D., head of radiation oncology at United Hospital. “This is a country with long waiting lists for treatment, so RapidArc will help us to treat many patients with advanced radiotherapy techniques.”

“There are huge challenges facing cancer treatment in Bangladesh, with many patients travelling to Singapore and India for treatment,” says Rolf Staehelin, head of international marketing at Varian, “and we hope RapidArc at United will play its part in starting to address the country’s extensive cancer burden.”

According to recently published reports there are currently over one million people with cancer in Bangladesh, with approximately 200,000 new cases being reported annually and approximately 150,000 annual deaths associated with the disease.

MEETING THE TRAINING CHALLENGE

Emerging economies have a tremendous need for modern radiotherapy equipment but funding is not the only restriction – there’s a knowledge gap that needs to be filled. To help alleviate this problem, Varian has established a series of training centers globally to help address this issue. Along with well-established training facilities in the U.S. and Europe, the company has invested in new centers in India, China and – shortly – Japan.

The Beijing Education Center, at Varian’s China HQ, is equipped with a beam-capable Trilogy linear accelerator in a shielded vault and a lecture laboratory with a suite of 17 workstations where students can learn treatment planning, product features and operation, as well as physics QA (quality assurance) in a hands-on environment.

In Mumbai, Varian has established a training center where comprehensive software suites are complemented by a VERT system enabling practical training to be facilitated using a virtual linear accelerator. A similar training center is due to open in Tokyo in November 2011.

“Having training in the local language demonstrates to customers that Varian is investing in their future,” says Jon Hollon, Oncology Systems’ director of worldwide training and education. “We want to do what we can to bridge this knowledge gap and ensure there are enough qualified therapists and physicists to cope with the burgeoning cancer populations.”

Varian also runs clinical schools at select customers, enabling cross-fertilization of ideas and best practices. “This is particularly helpful for techniques like motion management,” says Jon Hollon, “which you really need to see in clinical use to fully comprehend.” To date, Varian co-ordinates 13 clinical schools in Europe, South America, Australia and emerging economies.

| Trainees at Varian’s Mumbai
Education Center.

Varian trained
nearly
4,800
radiotherapy
professionals
in 2010



“We’re very aware that much of the developing world is under-equipped and that won’t change overnight, but by investing in more efficient delivery techniques and by working with like-minded partners globally, we hope to help cancer patients in developing regions gain access to modern radiotherapy treatments planned by well-trained physicists and delivered by well-trained therapists.”

© Michael Sandhu, VP, Oncology Systems, EMEA, CIS & APAC

PARTNERSHIPS TO EXPAND QUALITY CARE

The International Atomic Energy Agency (IAEA) has, among others, a mission to support the transfer of radiotherapy technology to low- and middle-income countries. To date, the IAEA has supported over 110 developing countries in Africa, Asia, Latin America and Eastern Europe. In several African countries, their first cancer centre has been developed with the support and expertise of the IAEA. Varian works closely with the IAEA to further these goals.

The company attends international meetings organised through the IAEA’s Programme of Action for Cancer Therapy (PACT), including the AGaRT (Advisory Group on increasing access to Radiotherapy Technology) forum established in 2010 which looks at the viability, availability and cost of existing radiotherapy technology for developing countries. Varian has already started offering new deals and prices for low-resource countries, helping them to utilize the funding they have to expand and improve their treatment options.

Vietnam is one of the world’s poorest-equipped nations for radiotherapy and Varian recently funded a fact-finding mission there led by leading Australian oncologist Dr. Graeme Morgan, aimed at helping the Vietnamese Ministry of Health to develop an education program for radiotherapy. Dr. Morgan’s subsequent report is currently being evaluated by the Vietnam Atomic Energy Institute and a decision is expected in 2012.

In China, Varian has sponsored more than 100 of the nation’s physicists to participate in the online Dosimetry Training Tool program that was developed at Stanford University. Varian has also been inviting the students to attend physics QA (quality assurance) training at the company’s new education center in Beijing. These courses have been taught by such luminaries as Prof. Fang-Fang Yin, chief physicist for Duke University, and Dr. Joseph Ting of MIMA in Melbourne, Florida.

Varian customer Yashoda Hospital, a private center offering advanced treatments for the booming Indian private sector, offers an unusual service – it sends a bus into local villages several times a month and brings patients back to Hyderabad for treatment.

The bus, resplendent in orange and equipped with a wide range of diagnostic equipment, travels to remote villages throughout the province of Andra Pradesh and screens patients for cancer. If people need treatment, they’re brought back to the hospital and treated without charge.

“Most of these people live below the poverty line,” says Dr. G.S. Rao, executive director at Yashoda Hospital. “Cancers of the cervix and head and neck are very common here and we are able to offer advanced treatments on our modern Varian linear accelerators.” In the five years that Yashoda has been running this service, more than 30,000 people have been helped.

At Yashoda, patients receive treatments on advanced linear accelerators with RapidArc, for fast and efficient IMRT (intensity-modulated radiation therapy) treatments. In fact the hospital – which has “A RapidArc Hospital” emblazoned at the entrance – has now treated more than 500 patients with RapidArc on a single machine. “With a great technology such as RapidArc we are able to give many more patients access to advanced cancer care,” adds Dr. Rao.



Yashoda has helped more than **30,000** people since the service started running five years ago

According to the Cancer Foundation of India, it is estimated that at any given point in time there are 2.0 to 2.5 million cancer cases requiring cancer treatment in India and this number is increasing by almost a million new cancer cases each year.