Streamlining Workflow
at the Tom Baker Cancer Centre

Electronic Medical Records: A Prescription for Quality Care

Expanding Treatment Options with Trilogy Radiosurgery

Total Eclipse: Essential Tools for Adaptive Treatment Planning
FEATURES

A Process Perspective on Patient Care  

At the Tom Baker Cancer Centre in Alberta, Canada, clinicians have learned to streamline workflow—and improve the quality of patient care—by analyzing clinical processes.

Total Eclipse  

Centerline explores the reasons why radiation oncology departments around the world are converting to Eclipse™ treatment planning systems.

Prescription for Quality Care  

Oncology electronic medical record (EMR) systems are beginning to show the power and potential to make a significant difference in the quality of cancer care.

IMRT Center Leads the Way  

In the southeast India state of Andhra Pradesh, Yashoda Hospital has become one of the first in the country to treat cancer patients with IMRT.

Expanding Treatment Options  

At the OSF Saint Francis Medical Center and Illinois Neurological Institute, neurosurgeons and radiation oncologists are using the Trilogy™ system for radiosurgery, IGRT, and IMRT as well as conventional treatments.

On Target with IGRT  

Clinicians at the Melbourne Internal Medical Associates (MIMA) Cancer Center have implemented a comprehensive IGRT program for fast, accurate patient positioning.

Prostate Cancer Brachytherapy  

Leading brachytherapy centers around the world are now using real-time, ultrasound-based treatment planning systems to expedite treatments.

IGRT in Europe  

In Europe, the rapid adoption of IGRT is leading to the wider acceptance of conformal IMRT as doctors gain the ability to position patients more accurately and compensate for tumor motion.

DEPARTMENTS

News  

Timothy E. Guertin Takes Reins as Varian CEO  

Timothy E. Guertin has become chief executive officer of Varian Medical Systems, succeeding Richard M. Levy, who stays on as chairman of the board.

First Trilogy Treatments in Australia  

At the Peter MacCallum Hospital in Melbourne, a three-year-old fibromatosis sufferer was among the first patients in Australia to be treated on a Trilogy accelerator.

SmartConnect: Help Arrives over the Internet  

With SmartConnect™ technology, Varian customers and service personnel connect remotely for online, real-time training and technical problem solving.

New Cancer Data Reporting Tool  

Varian and the Alberta Cancer Board have developed a new software tool for aggregating and analyzing data in oncology information systems.

Training updates
First Trilogy Treatments in Australia

A three-year-old fibromatosis sufferer was among the first patients in Australia to be treated on a Varian Trilogy™ medical linear accelerator. The treatment of Olivia Roberts, from the Melbourne suburb of Melton, took place at the Peter MacCallum Hospital in Melbourne, where the Trilogy accelerator was recently installed and officially unveiled at an inauguration ceremony attended by the premier and health minister of the State of Victoria.

The arrival of the Trilogy device means some of the world’s most advanced radiotherapy treatments are now available to Australian cancer patients. Using this versatile technology, doctors at the center will be able to offer cancer patients of all ages more targeted treatments using new methods, including IMRT, IGRT, and stereotactic radiosurgery (SRS).

“The Trilogy accelerator is the newest and most sophisticated of cancer treatment machines and will enable patients to receive faster and more precise radiotherapy, which will reduce side effects associated with cancer treatment,” said health minister Bronwyn Pike at the inauguration ceremony. “The Trilogy machine offers precise patient imaging and treatment on one machine, meaning the most precisely targeted treatment possible.”

Gillian Duchesne, MD, director of radiation oncology at the Peter MacCallum Hospital, says that unlike other linear accelerators currently used for radiotherapy treatment, the Trilogy system combines the best imaging and treatment technologies available in one machine. “The very tight specifications mean that the Trilogy is particularly suited to taking our pediatric, head-and-neck, and IMRT work,” she says. “The real-time imaging capabilities are going to open up an exciting new era for this hospital.”

SmartConnect: Help Arrives over the Internet

Anne Dawson, MD, radiation oncologist at Enloe Medical Center in Chico, California, was testing out some features of the new ARIA™ Oncology Information System, and found that she had some questions about how to use the software. Using Varian’s SmartConnect™ product, Jon Hollon, a Varian help desk supervisor, was able to provide Dawson with a customized two-hour training session—without ever leaving his hotel room in Mobile, Alabama, where he was attending a professional conference.

SmartConnect technology enables Varian service personnel to make direct connections over the Internet with customers’ workstations and equipment. This is proving to be extremely valuable, not just for training but also for solving technical problems at a customer site.

“SmartConnect has become our first line of defense for diagnosing a problem at a customer site,” says Dan Dubeau,
remote access project manager for Varian. “Without traveling, we can get into the customer’s system and see exactly what is going on. We can respond to problems quickly and often resolve the matter right then and there.”

During the training session, Hollon was able to see exactly what Dawson was seeing on her computer screen. The two could alternate taking control of the application. “It was almost as good as having him right next to me,” Dawson says. “And it was much better than trying to explain the issues over the phone when the other person can’t see what you see. I got very specific answers to my questions.”

SmartConnect has made it possible to offer customers follow-up training after they’ve had a chance to work with a new product for awhile, even if they’ve attended training courses or received on-site training in person. “People often receive formal training on a new product some time before they actually have the opportunity to use it in the clinical setting,” Hollon says. “Once they start using it, of course questions come up. That’s often a good time to schedule a SmartConnect-mediated training session.”

The SmartConnect tool also cuts down on the length of help desk calls. According to Dubeau, what might once have taken a customer half an hour to explain over the phone can now be observed and dealt with in as little as ten minutes.

“Our use of SmartConnect to assist customers has grown exponentially,” Dubeau says. “The number of customers using SmartConnect to obtain service and increase their uptime has quadrupled in the last year. This expanded use of remote servicing tools also reflects the degree to which radiation therapy technology has become increasingly software driven.”

“SmartConnect links our service personnel to complex devices at customer sites, so we can provide real-time support, remotely monitor the equipment, and diagnose problems,” says Kolleen Kennedy, Varian’s vice president for worldwide customer support services. “We can offer immediate technical assistance to customers in a private and secure manner, improving service call response times and maximizing clinical uptime.”

SmartConnect is offered free of charge to Varian customers who buy service contracts.

In addition, SmartConnect can be set up to proactively service customers’ equipment. For some kinds of issues, the SmartConnect system detects anomalies and automatically alerts Varian’s service team. A Varian service person then initiates a remote viewing event to diagnose and solve the problem quickly. “We often can solve problems that way before the customer even knows that there is a problem,” Dubeau says.

SmartConnect has become our first line of defense.”

Dan Dubeau, Varian Customer Support

“SmartConnect has become our first line of defense.”

In addition, SmartConnect can be set up to proactively service customers’ equipment. For some kinds of issues, the SmartConnect system detects anomalies and automatically alerts Varian’s service team. A Varian service person then initiates a remote viewing event to diagnose and solve the problem quickly. “We often can solve problems that way before the customer even knows that there is a problem,” Dubeau says.

“SmartConnect links our service personnel to complex devices at customer sites, so we can provide real-time support, remotely monitor the equipment, and diagnose problems,” says Kolleen Kennedy, Varian’s vice president for worldwide customer support services. “We can offer immediate technical assistance to customers in a private and secure manner, improving service call response times and maximizing clinical uptime.”

SmartConnect is offered free of charge to Varian customers who buy service contracts.

New Cancer Data Reporting Tool Developed

Varian Medical Systems and the Alberta Cancer Board of Alberta, Canada, have worked together to develop a new data analysis software tool for aggregating and analyzing data in oncology information systems to increase the effectiveness of cancer therapy.

The OncQT™ analyzer tool will enable clinicians to analyze the electronic information they already collect as they care for patients, and to generate reports about treatment protocols and outcomes.

“With this tool, clinicians can analyze electronic information they’ve already collected to discover treatment patterns and information about the success of specific treatment interventions,” says Heather Bryant, MD, PhD, vice president and chief information officer for the Alberta Cancer Board. “Making the most of electronic records will strengthen our clinical knowledge and enhance clinicians’ ability to treat this devastating disease.”

OncQT was developed in a joint project partially funded by the Canadian government’s Western Economic Development Program.

“It was great to work with the Alberta Cancer Board on this project,” says Maureen Thompson, head of marketing for Varian Oncology Information Systems. “The Alberta Cancer Board was one of the first customers for Varian’s electronic health record for medical oncology as well as a long-time user of the VARiS Vision™ radiation oncology information system. As their patient database expanded, they recognized that it could be mined for information about the cancer care they were providing and the outcomes for their patients. OncQT was designed to be that data mining tool.”

The new software tool incorporates a security component that protects patient privacy. “Users are given access to data in aggregate form,” says Thompson. “That’s important for U.S. customers, who must be able to build in protections required by HIPAA.”

“The Alberta Cancer Board itself will be able to use this new tool for the economic analysis of treatment data, as well as to enhance and implement clinical practice guidelines for the treatment of cancer patients,” adds Bryant. “This product will enable us to design and implement studies that determine the nature and extent to which treatment guidelines are being implemented and their resulting impact on patient care.”

Varian Medical Systems will market the OncQT analyzer tool under a licensing agreement with the Alberta Cancer Board.

In addition, SmartConnect can be set up to proactively service customers’ equipment. For some kinds of issues, the SmartConnect system detects anomalies and automatically alerts Varian’s service team. A Varian service person then initiates a remote viewing event to diagnose and solve the problem quickly. “We often can solve problems that way before the customer even knows that there is a problem,” Dubeau says.

“SmartConnect links our service personnel to complex devices at customer sites, so we can provide real-time support, remotely monitor the equipment, and diagnose problems,” says Kolleen Kennedy, Varian’s vice president for worldwide customer support services. “We can offer immediate technical assistance to customers in a private and secure manner, improving service call response times and maximizing clinical uptime.”

SmartConnect is offered free of charge to Varian customers who buy service contracts.

New Cancer Data Reporting Tool Developed

Varian Medical Systems and the Alberta Cancer Board of Alberta, Canada, have worked together to develop a new data analysis software tool for aggregating and analyzing data in oncology information systems to increase the effectiveness of cancer therapy.

The OncQT™ analyzer tool will enable clinicians to analyze the electronic information they already collect as they care for patients, and to generate reports about treatment protocols and outcomes.

“With this tool, clinicians can analyze electronic information they’ve already collected to discover treatment patterns and information about the success of specific treatment interventions,” says Heather Bryant, MD, PhD, vice president and chief information officer for the Alberta Cancer Board. “Making the most of electronic records will strengthen our clinical knowledge and enhance clinicians’ ability to treat this devastating disease.”

OncQT was developed in a joint project partially funded by the Canadian government’s Western Economic Development Program.

“It was great to work with the Alberta Cancer Board on this project,” says Maureen Thompson, head of marketing for Varian Oncology Information Systems. “The Alberta Cancer Board was one of the first customers for Varian’s electronic health record for medical oncology as well as a long-time user of the VARiS Vision™ radiation oncology information system. As their patient database expanded, they recognized that it could be mined for information about the cancer care they were providing and the outcomes for their patients. OncQT was designed to be that data mining tool.”

The new software tool incorporates a security component that protects patient privacy. “Users are given access to data in aggregate form,” says Thompson. “That’s important for U.S. customers, who must be able to build in protections required by HIPAA.”

“The Alberta Cancer Board itself will be able to use this new tool for the economic analysis of treatment data, as well as to enhance and implement clinical practice guidelines for the treatment of cancer patients,” adds Bryant. “This product will enable us to design and implement studies that determine the nature and extent to which treatment guidelines are being implemented and their resulting impact on patient care.”

Varian Medical Systems will market the OncQT analyzer tool under a licensing agreement with the Alberta Cancer Board.
Peter Craighead, MD, radiation treatment program leader at the Tom Baker Cancer Centre in Alberta, Canada, is passionate about developing what he calls “a process-centered approach” to improving the quality of patient care—without compromising his organization’s ability to provide care for all who need it.

In the last ten years, Craighead points out, the advent of IMRT and now IGRT have radically changed the nature of radiation treatment. “With a staff of over 150 people, how do you implement all these changes in a short period of time?” he asks. “We’ve had to become adept at developing successful implementation models.”

Clinicians at the center have learned to analyze processes and find ways of streamlining workflow. They ask themselves: Are we setting aside an appropriate amount of time to plan or deliver a particular treatment? Through the use of techniques like time-and-motion studies, or even just simple process-focused analysis, they have been able to determine how much time really should be allocated for particular tasks, and have identified ways of reducing the time, so more patients can be served.
Learning from time-and-motion studies

When the center was planning to implement IMRT for head-and-neck cancer cases, for example, the clinical team first did a time-and-motion study of their existing process for delivering 3D conformal treatments.

“We studied 10 patients to see exactly what it took to accomplish each of the steps, from making masks and doing simulations to planning and contouring, all the way through treatment,” says Harold Lau, MD, radiation oncologist. “That gave us a baseline. Then, when we started our IMRT treatments, we did the same thing and compared.”

Lau and his team found that, while contouring and physics QA took a bit longer for IMRT, the treatment planning itself was not that different. “Where we found it sometimes to be significantly more efficient was in actual treatment,” says Lau. “With some of the more complex 3D treatments, the therapists were entering the room to change the couch angle or get a certain field, whereas with IMRT, this was all done outside, remotely. As with any new technology, our first few IMRT treatments took longer; we were booking 45 minutes to an hour for the patient treatment. But after the learning curve, we’ve cut our treatment time for some head-and-neck cancer patients by more than half.”

Another time-and-motion study looked at the treatment process for prostate cancer. As a result, the clinical team found that, although they had been booking 15-minute time slots, they could accomplish the treatments in 9 to 12 minutes. “We could actually add several treatment slots per day,” says Craighead. “Six or so sessions per machine every day over the course of a year adds up to a lot more patients getting treated.”

Staff conducted another time-and-motion study when they implemented a dedicated radiosurgery system. “We knew, from talking with colleagues, that it took about three and a half hours to put a head frame on, do a CT scan, and plan and deliver a stereotactic radiosurgery (SRS) treatment,” Craighead recalls. “Rather than accept the conventional wisdom, however, we set up a time-and-motion study for the first 24 patients, to decide how we should budget our time. That gave us a range of times within which we are likely to finish a procedure.”

Applying better processes

But time-and-motion studies are just the beginning, Craighead points out. “If all you do is take the different durations and add them together, you don’t necessarily come up with an optimal process. If it takes half an hour to put the frame on, but then the patient waits for four hours for a scan, and another two hours for a physician, perhaps it makes more sense to organize the sequencing differently.”

In the case of the SRS treatments, the clinical team decided that, instead of scheduling patients one at a time and treating them sequentially, they would treat two at a time, preparing one patient for treatment while the other was being treated. “We put the frames on at the same time, and then they get their CT scans in sequence,” Craighead says. “Instead of treating one patient, finishing, and starting the next, we can double up on our throughput.”

In addition, each time the center rolls out a new Radiation Therapy Oncology Group (RTOG) protocol, managers produce a process map for the particular treatment, to arrive at an accurate determination of how many patients can be enrolled and what kind of human and other resources are required.

“Our clinicians routinely sit down with the findings from time-and-motion studies, consider their own experience and observations, and design a process that is followed for 12 months and then assessed again,” Craighead says. “Our managers have been trained in this regard, so they are constantly reviewing how we do things, particularly when treatments are complex, as they are with radiosurgery, IMRT, and image-guided treatments. We have to understand how much time new processes really take; otherwise we’ll get caught with too few staff or attempting things we can’t realistically achieve.”

“We can’t allow the fear of adding new technology to stop us, because our task is to provide the best patient care that we can.”

—Erin McKinnon, Tom Baker Cancer Centre, Alberta, Canada
Adding Trilogy treatments

According to Craighead, the Tom Baker Cancer Centre is about to bring online a Trilogy™ accelerator for image-guided radiosurgery, outfitted with RPM™ respiratory gating for dealing with intrafraction tumor motion. The Trilogy system, designed for speed, accuracy, and versatility, will offer Craighead’s team new possibilities for improving clinical processes and speeding treatments. It can be used, for example, with its FramelessArray™ optically guided cranial SRS immobilization system to achieve precise patient positioning without a rigid fixation frame. And beam shaping can be accomplished with a multileaf collimator, making it possible to treat larger lesions or multiple brain metastases very quickly.

According to Erin McKinnon, one of two radiation therapy managers, the arrival of the Trilogy machine will lead to a number of process-oriented projects for working out how the clinical team can best deploy the new technology. “The culture in our department acknowledges that we are in a continuously changing field, and we embrace that,” she says. “All the changes—from 3D treatments to IMRT, and now IGRT—allow us to excel at patient care.”

“We’re motivated by evidence,” adds McKinnon. “When evidence shows that a new or different approach will make things better for patients, then that’s something we want to learn. We can’t allow the fear of adding new technology to stop us, because our task is to provide the best patient care that we can.”

And, Craighead adds, the Tom Baker Cancer Centre, along with its sister organization, the Cross Cancer Institute in Edmonton, is in the process of standardizing on a comprehensive Varian platform comprising Acuity™ simulation, Clinac® and Trilogy accelerators, the On-Board Imager® device, the RPM respiratory gating system, Eclipse™ treatment planning software, and the V ARiS® information management system with electronic medical records for both medical and radiation oncology.

“It makes a lot of sense to have your systems compatible with one other,” Craighead says. “Between the two big cancer centers in Alberta, we treat about 6,700 patients each year. We need seamless access to information, with everything tied together. With Eclipse on every workstation, we can do our contouring anywhere and download the plan directly into the treatment machine; we don’t have to rely on cumbersome work-arounds to get our plans into the treatment system. Since we’re moving into image-guided and adaptive radiotherapy in a big way, we need those efficiencies. Small efficiencies add up, and that will make it possible for us to offer the highest standards of care to the greatest numbers of patients—exactly when they need us.”
Total Eclipse

Radiation oncology departments around the world are converting to the Eclipse™ treatment planning system. Centerline explores the reasons why.

For many clinicians, the switch to Eclipse treatment planning software begins with a shift toward IMRT and ends in smooth implementation, improved workflow, better treatment plans, and streamlined QA processes. The results are impressive.

"Eclipse will enable us to start on the path to take our current IMRT treatments from four percent of our plans to an anticipated 25 percent within the next year," says Robin Garcia, head of physics at Clinique Sainte Catherine in Avignon, France.

"Our ultimate goal," says Dow Wilson, president of Varian’s Oncology Systems business, “is to enable clinicians to use image data obtained at the time of each treatment to modify and fine-tune a patient’s treatment plan going forward, as the patient’s tumor responds to treatment. Eclipse now offers many new tools that are essential for the rapid adoption of image-guided and adaptive approaches to radiotherapy.”

Smooth implementation

Charles Mayo, PhD, is the assistant director of medical physics at the University of Massachusetts Medical Center in Worcester, Massachusetts. For Mayo, the conversion from CMS to Eclipse software was a smooth process. “Speed was improved by a factor of three,” he says, “and because Eclipse was improving our QA on many fronts and making us much more efficient, there was a lot of enthusiasm. Overall, it was a smooth conversion, and Eclipse was easily adopted.”

Because Eclipse integrates so transparently with the VARiS® oncology information system, Clinique Sainte Catherine’s Garcia and his team were able to keep human and machine error to a minimum during the implementation process.

Eclipse is in frequent use at D3 Advanced Radiation Planning Services in Pittsburgh, Pennsylvania. D3 provides treatment plans for the University of Pittsburgh Medical Center’s cancer centers and also acts as an independent consultant, providing plans for 50 clients around the country using both Philips’ Pinnacle and Varian’s Eclipse systems. “We’re a very busy office, typically generating around 400 plans a month, and so we commission Eclipse on a regular basis,” says Ron Lalonde, PhD, chief scientific officer. “It’s very quick to create and generate a beam model in Eclipse for both ordinary dose calculation and IMRT.”

“Our QA has improved from 45 to 60 minutes a patient all the way down to 10 to 15 minutes.”

—Greg White, Moores Cancer Center, San Diego, California

Improved workflow

At the Moores Cancer Center of the University of California, San Diego, “Our workflow has definitely improved” with Eclipse, says Greg White, CMD, senior medical dosimetrist. “Compared to Philips’ Pinnacle, moving a plan to treatment is much simpler with Eclipse. Most of my department is familiar with the Microsoft Windows interface used by Eclipse. As I tell them, everything they need is either a right mouse click away or under a menu.”
And at the University of Massachusetts, Eclipse has reduced the time it takes to generate plans. “That gives planners more time to try different strategies for improving dose distribution,” says Mayo. “It also means that we don’t need quite so many people per plan as we did with CMS.”

D3’s Lalonde concurs. “Because 99 percent of our plans are for IMRT, we do things that are fairly dose calculation intensive. Dose calculation with Eclipse is twice as fast as Pinnacle,” Lalonde says. Further, “There is no question that the fluence optimization process has improved our IMRT planning. Because it’s interactive, you can tweak the plans on the fly and generate better plans than on the Pinnacle system.”

The implementation of Eclipse has also led to workflow improvements at the Northern Illinois Medical Center. “Using CMS for IMRT was very cumbersome,” says Jerry Soen, director of medical physics. “Eclipse, however, is very smooth, intuitive, easy to learn, and efficient to use.” Dose calculation times have been reduced from 45 minutes with CMS to “hardly noticeable” times with Eclipse.

**Pinpoint accuracy**

Eclipse dose calculation, using the new AAA™ superposition convolution algorithm, is becoming widely recognized for its accuracy. “We were one of the first centers to implement the new AAA dose calculation algorithm,” says Soen. “From a physics standpoint, I can guarantee the accuracy of the doses from virtually any treatment I plan on Eclipse to less than one percent using the AAA algorithm.”

At the Moores Cancer Center, White’s experience with the AAA algorithm has been similarly positive. “Our IMRT optimization calculation times are much faster with AAA,” he says.

**Better contouring**

Mayo believes that Eclipse’s contouring and plan evaluation tools have improved the physician’s ability to plan radiotherapy treatments. “The tools for assessing the quality of the plan—particularly when you have multiple plans—are greatly improved and there was no corollary in CMS at all for doing that,” he says.

At the Northern Illinois Medical Center, Soen found that “structure segmentation was a laborious task on CMS, but Eclipse’s contouring tools help smooth the process. It means you don’t have to think about every single slice or contour. Instead, you can set a series of parameters and then Eclipse generates a 3D contour for you by making the appropriate selection. This has been very helpful and useful.”

**Time-saving templates**

“We use the structure templates and IMRT objectives libraries,” Soen says. “With a preset library, we don’t have to reinvent the wheel, and that can save us some time in complex plans. We simply pull up a particular template or library and adjust from there.” Lalonde takes advantage of the templates because “D3 has a large number of planners and a large office, and we want to maintain a consistency of approach for both ourselves and our clients. Having these templates allows us to produce more uniform results, so we use them extensively.”

Garcia considers the templates an important time-saver and uses them regularly, as does Mayo. White mainly uses the plan template and IMRT objective libraries. “The templates mean we do not have to start each case from scratch,” White explains. “So they have positively impacted our treatment planning process. What’s more, they can be modified for each patient and then resaved.”

**Streamlined IMRT QA**

Eclipse software, along with Varian’s Portal Dosimetry product, also speed up the IMRT QA process. “I’m a big fan,” says White. “Our QA has improved from 45 to 60 minutes a patient all the way down to 10 to 15 minutes.”

Lalonde has also seen the benefits of portal dosimetry. “I have commissioned portal dosimetry at four different centers as part of our consulting service,” he says. “Initially, this didn’t shorten the process because we were cross-checking the results with a phantom experiment. But once we gained comfort with the technique, I would say that portal dosimetry reduced the QA time by half.”

With portal dosimetry, Lalonde points out, the setup and delivery are straightforward enough to be handled easily by therapists, and physicists can analyze the results at a later time. “Because the entire process takes place within Varian applications,” he says, “the acquisition, transfer, and storage of data is greatly simplified.”
Oncology EMR Systems: Prescription for Quality Care

By Nancy Heifferon
What technology is likely to have a profound impact on the future of cancer treatment? While an innovation in diagnostic imaging or a breakthrough in personalized medicine might make headlines, out-of-the-spotlight electronic medical record (EMR) systems are beginning to show the power and potential to make a significant difference in the quality of cancer care.

For their perspectives on the value of EMR systems in oncology, Centerline spoke with a multilocation medical oncology practice in Gaston, North Carolina; a comprehensive treatment center with several clinics in Fort Worth, Texas; a medical oncology department in a major London teaching hospital; and a province-wide cancer care provider in Alberta, Canada.

All have chosen an EMR system that is specific to oncology over general purpose systems because of the unique nature of the oncology practice. No other specialty is like oncology for the complexity of the disease, the multidisciplinary treatment, the high toxicity of the medications, and the unrealistic reimbursement schemes. An oncology-specific EMR system addresses these challenges by providing guideline-driven care, workflow management, and decision support as well as incorporating everyday clinical operations such as charge capture and billing, scanning, faxing, dictation, lab work, clinical trials, and communication with external healthcare providers.

Supporting the best decisions

An oncology-specific EMR enhances the quality of patient care in ways that a generic system cannot.

When the Center for Cancer and Blood Disorders in Fort Worth, Texas, first went digital eight years ago, they wanted more than an online viewable chart; they wanted decision support. Generic EMR systems just aren’t a good fit for oncology, says William Jordan, MD, president. While they can capture the typical historical and physical findings that all clinicians use, they can’t manage chemotherapy regimens with sophisticated dose calculations, capture and measure toxicities, or manage clinical trial programs—all essential capabilities for oncology practices. “We were determined to use an oncology-specific health record because oncology is not like other specialties,” says Jordan. “We developed our EMR program to be able to query into what we do. We know there is an ocean of information in patient charts that can help us understand what we do, how we do it, and the outcomes, and to change our behavior to increase the quality of care.”

Decision support was also vital to St. Bartholomew’s Hospital in London. “We face increasingly complex demands for information about who we are treating and with what,” says Chris Gallagher, MD, clinical director of St. Bartholomew’s Cancer Centre. “This is the sort of data that only an oncology-specific system can provide. The system will help us review up-to-the-minute data on response and toxicity to better tailor treatment to each patient’s particular requirements.”

The Cancer Board of Alberta, Canada, operates regional and community clinics, but its larger mission is to coordinate all cancer research, prevention, and treatment programs in the province of Alberta. “Our mandate is to provide the highest standard of cancer control to a province of three million people, in which we see 13,000 new cases of cancer per year,” explains Heather Bryant, MD, PhD, chief information officer for the Alberta Cancer Board. The board is in the process of implementing the MedOncology™ EMR from Varian province-wide. All of the board’s 17 facilities access the EMR by virtual private networks. “Outcome analysis is part of what we do,” says Bryant. “We see the potential of using the information captured to manage the care process better. We are building a rich database describing our experience, which we could not do before.”

While every healthcare provider believes it is delivering the best care, the right EMR gives oncology practices the means to prove it. “We are able to share data with our payers relative to clinical patient outcome in ways they have never seen before,” says Jordan of the Center for Cancer and Blood Disorders in Texas. “For example, we prescribe white and red cell growth factors at a higher rate than some other clinics in our area, and we are keeping people out of the hospital. This is not our subjective opinion; we can demonstrate better outcomes because of the EMR.”
Managing the care process

Oncology-specific EMR systems enhance the quality of patient care by helping practices to manage the care process more efficiently. From the moment patients arrive to the moment they check out, every step of their journey is captured electronically by the EMR.

“The EMR forces a practice to take a new look at patient flow,” says Scott Gilomen, the practice administrator of Gaston Hematology and Oncology in Gastonia, North Carolina. Gaston is a six-physician treatment center with three locations that specializes in medical oncology. “We can pull a report from the system detailing step-by-step how the patient moved through our office, and the variance in minutes between the expected and actual arrival times at each stage. We use this information to determine where the bottlenecks are in our office flow and streamline our services.”

Gilomen thinks the audit trail provided by the EMR is the most valuable tool available for clinical management. Every entry made in the EMR is tagged with the date and user identity. “Our practice uses the audit tool to help with training personnel,” Gilomen says. “It is very easy to see who needs additional training.”

In addition to improving the quality of the patient experience, Gaston’s EMR system is saving the practice US$100,000 a year, almost half from reduced transcription costs alone. At this rate, Gilomen expects the system to pay for itself in three years.

Ensuring patient safety

While cost savings are undeniably important, the real bottom line is improved patient safety. Cytostatic drugs are so powerful that even small errors can have profound consequences. A 2003 study found some kind of error in 22 percent of the prescriptions examined.1 In two percent of the cases, the error was serious. St. Bartholomew’s Hospital implemented VARiS MedOncology, Varian’s oncology-specific EMR, in large part to reduce the risk of human error when prescribing chemotherapy. The EMR provides a customizable library of regimens to choose from—including clinical-trial protocols. It also calculates doses and checks contraindications automatically. “[MedOncology] has been shown in various studies to significantly reduce the incidence of human error in the prescribing process,” says St. Bartholomew’s Gallagher.

Integrating information

The EMR enhances patient safety in another way as well—through the integration of information. “The modern treatment of cancer is organized through multidisciplinary teams and not separate departments, so that integration of information and improvement of communication between departments is of greatest importance in ensuring safe and optimally effective treatment,” says Gallagher. Integration of the MedOncology system with existing hospital networks gives the hospital a fully integrated oncology department.

The Alberta Cancer Board is working toward integrated care throughout the entire province. “We definitely see the benefit of being able to exchange information across healthcare access points across the province, so that information captured at one point of care can be made available to other points of care,” says chief information officer Bryant.

Providing comprehensive care is the mission of the Center for Cancer and Blood Disorders, and its EMR, VARiS MedOncology, is central to achieving it, says Jordan, the center’s president. “The center is founded on the belief that a comprehensive community cancer center, where there is an integration of services, enhances the quality of patient care.”

At the center, the Radiation Oncology, Surgical Oncology, and Medical Oncology departments all use the EMR system for their clinical records. “When radiation oncologists input their clinical data into the MedOncology record,” concludes Jordan, “it provides us with excellent communications across the board for patient care. The EMR is the core of our integration of multidisciplinary systems.”

Nancy Heifferon is a Silicon Valley–based freelance writer.

In 2004, a super hospital in the southeast India state of Andhra Pradesh became one of the first in the country to treat cancer patients with intensity-modulated radiation therapy (IMRT). Such treatments, focusing on head-and-neck and prostate cancer patients, enable clinicians to boost doses while sparing sensitive sites such as the parotid glands and the spinal column.

Two years on, Yashoda Hospital—in the heart of the “twin cities” of Hyderabad-Secunderabad—is still one of only a dozen or so centers routinely treating with IMRT in a nation of more than 600 million people. Their experience has been so positive that doctors at the hospital will soon expand their IMRT program to also treat lung and breast cancer patients.

“We believe IMRT is a major breakthrough over conventional radiotherapy, and it is a particularly significant leap forward in treatments for this region,” says M. Dinesh Kumar, Msc, Dip. RP, chief medical physicist. “We have had a very good response among patients in this part of the country.”

The private Yashoda Hospital is the only one of ten cancer clinics in the Hyderabad region to treat using modern Varian equipment. The other hospitals have older linear accelerators or inefficient cobalt machines.

Kumar and his radiation oncology colleagues have carried out almost 70 IMRT treatments in the two years since they commenced their program. About five patients a month benefit from the increased doses and greater conformity afforded by this type of treatment.

“IMRT enables us to give doses of up to 82 Gy, which would be impossible with conventional radiotherapy,” adds Kumar. “We are better able to spare parotid glands from residual exposure when treating head and neck tumors, and we can deliver the beam without impacting the rectum and bladder for prostate treatments.”

On average, IMRT cases take up to three days from planning to implementation at Yashoda. “After we’ve selected a patient,” explains Kumar, “we spend much of the first day acquiring images for planning. On day two, we contour both the target and the organs at risk and plan the treatment.” Clinicians at Yashoda plan using Helios™ inverse planning software, part of Varian’s Eclipse™ treatment planning system.

“One we get an acceptable plan and after proper approval from the radiation oncologist,” continues Kumar, “we transfer this plan in phantom for some plan-specific quality assurance.” The QA planning tends to take place in the evening, after the completion of the day’s regular treatments in the center’s sole linear accelerator, a Varian Clinac®. “We carry out plan-specific QA,” he adds, “which is basically point dose measurement using ion chambers and a 2D dose distribution comparison using film dosimetry.”

Treatment is usually delivered on the third day, although this could be delayed by a day if planning and contouring takes more time than expected. During treatment delivery, Kumar and his colleagues compare the orthogonal set-up portal images with the digitally reconstructed radiograph (DRR) images.

Yashoda Hospital, which treated more than 625 cancer patients in 2005, is soon to acquire an image-guided radiation therapy (IGRT) gating system that will enable the clinicians to expand their IMRT program to breast and lung tumors.
At the OSF Saint Francis Medical Center and Illinois Neurological Institute, clinicians from the Radiation Oncology and Neurosurgery departments are treating patients using the Trilogy™ linear accelerator from Varian Medical Systems for single and hypofractionated radiosurgical procedures as well as for image-guided, intensity-modulated, and conventional radiation treatments.

Our Trilogy system incorporates Varian’s kV On-Board Imager® device, an optical guidance system for monitoring patient position during treatment, and the RPM™ respiratory gating system for dealing with respiratory motion.

Clinicians here have now used the Trilogy system to deliver treatment for a wide range of conditions.

**Brain and spine indications**

**Metastatic spinal disease.** In the past, spinal metastases were treated with chemotherapy or long courses of fractionated radiotherapy. With Trilogy, we can use either single or hypofractionated radiosurgery to shorten the treatment time and accelerate pain control while protecting the spinal cord from radiation effect. The use of kV and cone-beam CT imaging has eliminated the need for fiducial marker placement, allowing this modality to be used more readily, thereby reducing the number of patients requiring extensive spinal reconstructive surgery or being left with unrelieved pain.

**Brain metastases.** We have launched a research study for treating the resection cavity after excision of a solitary metastatic lesion in the brain. In the past, we would have offered these patients a fractionated course of whole-brain radiation therapy. Now we treat a volume encompassing the resection cavity plus five millimeters in only five fractions delivered over one week. The object is to decrease morbidity and the potential for late dementia.

Patient immobilization in these cases is accomplished using Varian’s noninvasive mask and bite block devices.

**Other tumors abutting critical structures.** Using Trilogy, we can deliver fractionated radiotherapy with the assurance that we are targeting more accurately. For example, we used Trilogy’s imaging and positioning devices when treating a tumor that surrounded a patient’s optic chiasm in order to avoid causing blindness as a side effect. In cases like this, we use Varian’s optical guidance system to monitor the position of reflective markers on the bite block immobilization device. This allows us to set up the patient for kV imaging and to monitor for any patient movement during treatment.
Body indications

Retreatments. With Trilogy, we have the precision necessary to treat tumors that are adjacent to areas that have already received radiotherapy, ensuring that we are not delivering additional dose to previously treated areas. For a successful retreatment of rectal cancer, we used cone-beam CT imaging to check tumor position and made daily adjustments to keep the small bowel safely out of the targeted area.

Lung cancer cases. In conjunction with thoracic surgery, we have treated five cases of lung cancer using the Trilogy system’s RPM respiratory gating technology to manage intrafraction tumor motion. These cancers are being treated with a hypofractionated regimen involving three treatment sessions over two weeks. Using cone-beam CT images, we are able to accurately position the beam and even observe rapid tumor responses to these large dose fractions.

Prostate cancer. We now preferentially treat all curative external beam prostate cancer patients on the Trilogy system. Patients treated with large numbers of fractions have their set-up accuracy checked daily with simple kV imaging rather than cone-beam CT in order to minimize patient radiation exposure. We place three fiducial markers in the prostate prior to the treatment planning CT simulation. Knowing their relationship to the prostate enables us to adjust the target center for daily variations in the prostate position. We truly appreciate the exactness and ease of matching prostate fiducial markers using the 2D/2D marker match feature of the On-Board Imager. We now have the confidence needed to tighten the IMRT margins and escalate the doses to the prostate. Our five-to-seven-field dynamic mode IMRT treatments are completed in a 15-minute time slot.

Developing indications. Whereas in the past we used only selective internal radiation by Y-90 infusions for selected liver cancers such as hepatocellular carcinoma and liver metastases, we now have added Trilogy treatment with hypofractionation to our therapeutic options. The ability to use cone-beam CT for localization obviates the need for placing fiducial markers and makes the treatment planning and delivery process much simpler.

Positioning with the On-Board Imager

For our spinal radiosurgery cases, we position the patient using the On-Board Imager to perform a 2D/2D image match. That gets the patient positioned to within approximately one to two millimeters. For many cases, this is sufficient. For others, we go on to generate a cone-beam CT image that further refines the set-up accuracy. We use cone-beam CT imaging for spine, lung, and a variety of abdominal cancer cases to visualize soft tissues that would not be visible with planar images.

Speedy treatments

The Trilogy accelerator delivers the radiation dose rapidly at 1,000 monitor units per minute—two to three times faster than the Cyberknife technology—and, in these cases, speed is crucial. When patients are immobilized, even noninvasive fixation devices aren’t always comfortable. Speeding up treatment contributes enormously to patient comfort, and reduces patient motion. Even intracranial frameless radiosurgery treatments can be delivered in just 20 to 30 minutes, including patient setup and beam delivery.

Most other radiosurgery systems focus the treatment beam through circular cones. While the Trilogy system allows us to use cone-based beam modalities, we also have the option of delivering radiosurgery using intensity modulation with the dynamic mode multileaf collimator (IMRS). That means we can treat larger and irregularly shaped volumes that are difficult to treat using cone-based beam shaping. With the Trilogy, we can thus elect to treat individual patients with either frame-based or frameless intracranial radiosurgery using cones or IMRS, a clinical flexibility that is unmatched.

Roger Crawford is oncology services operations director for the OSF Healthcare System. Patrick W. Elwood, MD, is director of the Illinois Neurological Institute and professor of neurosurgery for the University of Illinois College of Medicine at Peoria. W. Gregg Devanna, MS, is chief medical physicist at the OSF Saint Francis Medical Center. James L. McGee, MD, is the medical director of radiation oncology at OSF Saint Francis Medical Center and director of oncology services for the OSF Healthcare System.
“Any time you’re treating a patient with conformal radiotherapy, you need IGRT,” Scarbrough asserts. “IGRT is ultimately about increasing accuracy. And when do we want our treatments to be more accurate? Always!”

Joseph Ting, PhD, chief medical physicist at the MIMA Cancer Center, concurs absolutely. “Without a tool like the On-Board Imager, we would not have a practical way to set up patients up for treatment with the millimeter precision we need to be sure we’re always targeting the right place,” he says.

Scarborough, Ting, Nanialei Golden, MD, and their colleagues have implemented a comprehensive IGRT program using Varian’s On-Board Imager device. Since acquiring the technology in April 2005, this team has treated prostate, head-and-neck, lung, liver, brain, and other cancers, and their observations of how tumors move and change over a course of treatment have only served to confirm that image guidance is absolutely essential for adapting to those changes and staying “on target.”

“We are excited about the results of prostate treatments with precision alignment of the prostate using orthogonal kV X rays to locate implanted marker seeds,” Ting says. “Not only do we know where the prostate is on a daily basis, we can position the prostate to within one millimeter for every treatment fraction. Clinical results definitely demonstrate the benefits of such precision.”

The MIMA team has also been looking at how target volumes and surrounding tissues change over a course of treatment for head and neck tumors. “Our cone-beam CT (CBCT) scans show major differences in anatomy after just a few treatment fractions,” Ting says. “Not only have we seen that the tumors can shrink so that healthy tissue ends up inside the treatment field, but anatomical structures like the parotid glands shift position. It takes weekly CBCT imaging to show us when we need to go back to the CT simulator, rescan, recontour, and work up a revised treatment plan. That’s the only way to ensure that we’re really sparing the parotid glands.”

Enabling extracranial radiosurgery

Clinicians at MIMA are equally enthusiastic about using IGRT to facilitate radiosurgical procedures in the brain and body. For example, they recently treated a metastatic liver...
tumor with Dynamic Targeting IGRT. The novel radiosurgical procedure involved three treatments delivered every other day over a five-day period.

“Prior to each treatment, we used the On-Board Imager to take orthogonal X-ray images of the liver and matched them against reference images from the treatment plan. We were amazed at how well the liver showed up on the radiographic X-ray images,” Scarbrough says. “We could see enough detail to make the necessary positioning corrections. We then generated a cone-beam CT image as a check, to verify that our calculations were correct in three dimensions.”

**Enhancing breast treatment**

In another project, MIMA clinicians are investigating how Dynamic Targeting IGRT can improve how breast cancer patients are set up for treatment. Many centers are treating breast cancer with IMRT, either inversely planned or using electronic tissue compensation. Patient positioning processes using conventional filming methods have been difficult for IMRT breast treatments because of the precision required.

“Traditionally, breast patients are set up with laser beams and external tattoos as well as weekly port films using mV X rays,” Ting says. “It can be a laborious process, as the therapist may need to enter the treatment room to adjust the setup. Particularly for large breasts, this is less than optimal, and the added radiation dose delivered to the contralateral breast is a concern.”

Consequently, MIMA clinicians have begun employing an IGRT protocol that involves placing four small (0.8 mm diameter) markers on the patient’s breast for CT simulation and then for each treatment. The locations for these markers are tattooed onto the patient’s skin so they can be removed and reapplied each day. Using the marker-matching feature of the On-Board Imager, the therapist compares a set of orthogonal kV X-ray images with the digitally reconstructed radiographs (DRRs) from the treatment plan, and moves the treatment couch into the correct position remotely and automatically from the treatment console. MIMA clinicians have been evaluating this breast set-up technique since February 2006, and find that it is more accurate and takes less time. “Most importantly, it reduces the dose to the contralateral breast when compared with orthogonal imaging using mV X-ray beams,” Ting says.

**Novel uses of cone-beam CT**

This team also uses the On-Board Imager to generate cone-beam CT images whenever treating targets that are adjacent to sensitive critical structures. “In one case, we were treating a lesion right behind the patient’s eye,” Ting recalls. “We wanted to protect the optic nerve as well as the eye itself. We used the cone-beam CT matching feature to shift the patient into position. That kind of treatment really cannot be done without IGRT.”

“CBCT is clearly going to be a step forward towards reducing radiation toxicity and possibly increasing cure rates,” says Scarbrough. “We are in the process of analyzing the system critically to see just how much improvement it’s going to bring us, but I think it’s going to be accepted by clinicians rapidly and become the key tool leading us into an era of dynamic, adaptive radiotherapy.”

**Educating radiation therapists**

According to Ting, IGRT processes are changing the nature of the radiation therapist’s role in delivering radiotherapy. “The training of therapists—not doctors, not physicists, not dosimetrists—is key to a successful launch of an IGRT program. Ultimately, it is the therapist who will stand at the treatment console, generate kV or cone-beam CT images, and use the image-matching software to reposition patients for treatment,” says Ting. “It takes time to get familiar with those processes and develop the judgment you need to make decisions on the spot.”

Consequently, the MIMA Cancer Center has launched a hands-on training program for radiation therapists. The MIMA “IGRT School” offered its first training sessions in March 2006. For further information, contact Fred Fangman via e-mail at: fred.fangman@mima.com.
Time is the enemy when it comes to high-dose-rate (HDR) brachytherapy prostate procedures. Clinicians would like to deliver two fractions on the first day, three fractions in 24 hours, or four fractions in two days, which means the time to first fraction is critical. But traditional methods have compounded time challenges by requiring the use of CT scans for needle and target localization.

In recent months, leading brachytherapy centers around the world have been adopting Varian's new Vitesse™ 2.0 system in combination with the BrachyVision™ 3D planning system. It’s an approach that enables these time challenges to be met by eliminating the CT scanner step and creating the treatment plan in parallel with patient recovery.

Vitesse 2.0 is an ultrasound-based brachytherapy treatment planning system that speeds up prostate cancer treatments and potentially reduces the time patients need to spend in the hospital. It enables clinicians to quickly capture the data needed to plan needle locations, monitor and adjust the positions as the needles are inserted, identify the final needle position in the patient, and export the entire dataset to Varian’s BrachyVision system. The plan for the HDR prostate procedure can then be completed and the patient treated.

“Previously, hospitals wishing to employ this temporary implant technique have been hampered by the difficult logistics,” says William Hyatt, Varian’s vice president for oncology systems operations and brachytherapy products. “The implant takes an hour. The patient goes to Recovery, then to Radiology for a CT scan, then waits for the physics staff to generate a treatment plan, then gets the first radiation treatment. Often by then it is too late to get a second radiation dose on the same day and the patient must be kept in the hospital overnight. Now, with Vitesse, the process is simply implantation, treatment planning during recovery, then treating. This can easily reduce the time to first treatment by up to two hours.”

ABOVE | Vitesse makes it possible to see the placement of HDR brachytherapy needles within a volumetric ultrasound image.
Early adopters

Long Beach Memorial Medical Center in California, considered one of the premier brachytherapy clinics in the world, recently introduced Vitesse 2.0 into their standard HDR procedure. Anil Sharma, PhD, chief medical physicist, says, “If you have to take the patient out of the operating room for a CT scan, you lose a lot of time between fractions. But with the real-time ultrasound imaging of Vitesse, we can import all the images into our planning system right there in the OR. The treatment plan can then be based on these images.

“It’s a breakthrough in prostate brachytherapy treatments because you can give two fractions on the first day and the patient only needs to stay in hospital for one night. That means a happy patient and a happy hospital.”

Sandra Victor, MD, chief radiation oncologist at the Springfield Regional Cancer Center in Springfield, Ohio, says the Vitesse 2.0 system is just what her team has needed for some time. “We have been doing a lot of HDR treatments for breast and gynecological cancers, but we have held off doing prostate because I have never felt CT is precise enough for HDR,” she says. “I like Vitesse a lot because I think the ultrasound planning is more accurate than CT; and because it’s ‘real-time,’ you do not have as many positioning variables such as patient movement and tumor motion.”

Victor added that the center’s prostate seed program would now be converted to HDR treatments. “HDR gives just about the perfect treatment for prostate, and radiation oncologists like perfection,” she says.

Dorin Todor, MD, associate professor in the Department of Radiation Oncology at Virginia Commonwealth University Hospital in Richmond, Virginia, and his team carried out their first HDR prostate treatment using Vitesse 2.0 in early February. “Going forward, we will use Vitesse for every prostate treatment,” he says. “It’s a pretty significant step forward and it will make a big difference, particularly for the patient. The whole process is simplified and quickened using this system. Brachytherapy is not always a nice procedure to have or an easy procedure to tolerate, so anything that speeds up brachytherapy procedures has got to be a good thing.”

He says the clinic’s previous procedure was to carry out a preplan of the patient’s treatment based on an ideal configuration of needles. They would go into the operating room and the physician would do his best to carry out the plan as intended, using the preplan. Now, he says, physicians could be 100 percent certain they are treating with the real needle positions and the real prostate contours, thanks to the real-time ultrasound imaging.

Flexible data acquisition

Vitesse 2.0 offers two main image acquisition methods: transverse image capture (the “step-in-and-out” technique) and the new Twister™ longitudinal mode. The Twister option enables doctors to acquire target data by rotating the probe in longitudinal mode. For HDR prostate brachytherapy procedures, this means the ability to acquire the prostate volume from live ultrasound, contour the prostate and place needles, acquire ultrasound images with the needles in place, identify final needle paths, and export the data via DICOM RT to the BrachyVision workstation.

“Compared to step-in-and-out techniques, the addition of the optional Twister volume acquisition module gives the benefit of speed, vastly improved data resolution, and less prostate distortion,” says Hyatt. “It means doctors can deliver the first fraction just minutes after the implant.”

Web-based seminars

To demonstrate the Vitesse 2.0 system, Varian has been hosting a series of web-based seminars. Ted Jackson, PhD, Varian BrachyTherapy’s head of research and development, outlines the Vitesse 2.0 features, while Rebecca Claydon, software product manager, demonstrates the use of BrachyVision to quickly optimize the dosimetry. The presentations take about 30 minutes and are followed by a question-and-answer session.

The first seven sessions, limited to 40 participants each, “sold out” within days of their announcement. A recorded version of the seminar is available for review anytime at http://varianbrachytherapy.webex.com. Review requires a password. To obtain the password and receive announcements of future seminars, e-mail your request to dave.hall@varian.com, listing your name, job title, institution name, and address.
IGRT in Europe: Coming on Fast

Image-guided radiation therapy (IGRT) has opened up new treatment possibilities as clinicians strive to boost doses to tumors while further minimizing damage to surrounding healthy tissues. The ability to adjust treatments “real-time” based on tumor motion—caused by the patient’s breathing cycle, natural tumor movements, or variations in patient setup—has not only led to the wider introduction of conformal intensity-modulated radiotherapy (IMRT) treatments but has also given doctors the confidence to dynamically adapt their treatments based on far superior imaging.
To date, the majority of Varian’s On-Board Imager® devices for IGRT have been sold as attachments on new linear accelerators rather than as upgrades to existing equipment. By April 2006, more than 200 On-Board Imager devices were installed or being installed at sites around the world. “For some time we had been predicting a rapid uptake of IGRT, and the response of hospitals around the world has borne that out,” says Tim Guertin, president and CEO of Varian. “The fact that most centers are acquiring On-Board Imager devices with new equipment shows that IGRT is a major driver for clinics acquiring state-of-the-art treatment capabilities.”

Another technology for using images to guide and adapt radiotherapy treatment is Varian’s RPM™ respiratory gating system, which tracks and coordinates treatment delivery with patients’ natural breathing patterns. This form of IGRT is most often used in the treatment of left-sided breast cancer, lung cancer, and other thoracic and abdominal tumors that are subject to respiratory motion.

In Europe, uptake has been similarly impressive. By March this year, 23 European clinics were equipped with—and clinically using—a total of 26 On-Board Imager devices for IGRT treatments. At Clinica Quadrantes in Lisbon, Portugal, Europe’s first Trilogy™ medical linear accelerator was operated clinically for the first time in March, with Pedro Chinita, MD, and his team treating patients with prostate and neck tumors.

In this article, Centerline takes a closer look at two European sites that are using Varian’s IGRT technology in innovative ways: At Clatterbridge Centre for Oncology in Liverpool, England, doctors are using the On-Board Imager’s 3D cone-beam CT imaging capability for routine stereotactic neurosurgical treatments, while at Klinikum Dortmund in Germany, clinicians have extended their respiratory gating program to treat lung cancer patients.

**Complex stereotactic neurosurgical treatments at Clatterbridge**

At Clatterbridge in February 2006, a 40-year-old female patient with a solitary brain metastasis received a single session of radiosurgery on a Varian Clinac® linear accelerator equipped with an On-Board Imager device for establishing the exact location of the lesion. The On-Board Imager device enabled doctors to pinpoint the location of the tumor using special cone-beam CT images and then to complete the treatment in less than an hour. Until now, this type of special treatment took up to four hours.

“The time-consuming nature of this sort of treatment has meant that we would normally have had to carry it out in the evening on specialized machines, after our routine work has been completed,” says Angela Heaton, research radiographer at Clatterbridge. “It could take up to two hours to check calibrations before we could even begin treating, and the whole process could take several hours, which was inconvenient for both the patient and staff and made it a relatively difficult treatment.”

She says stereotactic treatments could be further delayed when there was the need for neurosurgeons to attend and screw a head fixation device into the patient’s skull in order to keep the device in place during transfer between imaging systems. Doctors say the new imaging treatment process makes it possible to avoid this uncomfortable and time-consuming step for most patients.

The patient selected for this pioneering treatment had previous whole brain surgery for two brain metastases from an inoperable renal tumor in August last year, and although the primary tumor has not progressed, her long-term prognosis is still poor. A new 25-mm lesion had recently developed and was causing the onset of facial palsy and headaches from edema, which meant treating it could greatly improve her quality of life.

Using the Clinac accelerator’s 120-leaf multileaf collimator to shape the beam, clinicians delivered a 15-Gy stereotactic radiosurgery treatment from eight angles, carefully checking the patient’s head position between each treatment field. The entire treatment took less than an hour—about 20 minutes for patient positioning on the couch using a headframe, two minutes for cone-beam CT image acquisition, a further five minutes for online image matching, and about 20 minutes for treatment delivery.

“At present we could expect to do between 10 and 12 such treatments a year,” says Brian Haylock, MD, the center’s clinical director. “These patients have previously been treated out of hours because of time constraints, so this did not

“The Varian machine... has the versatility to handle routine radiotherapy treatments when it is not being used for neurosurgical cases.”

—Brian Haylock, MD, Clatterbridge Centre for Oncology, Liverpool, England
become routine. It’s now important that we do everything we can to improve the efficiency as well as maintain treatment accuracy and improve patient comfort. That’s why we want to move our stereotactic procedures across to the Varian machine, which also has the versatility to handle routine radiotherapy treatments when it is not being used for neurosurgical cases.”

Respiratory gating extended to lung patients at Dortmund

Earlier this year, a 65-year-old German became one of the first lung cancer patients in Europe to be treated with radiation therapy that is delivered in timed bursts to take account of tumor movement caused by breathing. His respiratory-gated treatment was carried out at the Klinikum Cancer Center in Dortmund using a unique monitoring system that tracks and coordinates treatment delivery with patients’ natural breathing patterns.

The RPM respiratory gating system made it possible for doctors to improve the treatment by boosting doses for the patient while sparing more of the healthy tissue surrounding his lung tumor. They were able to concentrate more dose on the tumor while reducing exposure of the surrounding healthy tissue by up to 22 percent.

“There’s no doubt that this approach enables you to better protect normal tissue, increase patient comfort, and have fewer side effects,” says Oliver Waletzko, MD, head of radiation oncology at Klinikum. “Because of this, we can safely boost doses to the tumor and have more effective treatments, all within a standard treatment time.” Respiratory gating is used regularly for left-sided breast cancer patients as a method of reducing the volume of the heart exposed to radiation, but it is much rarer for lung patients.

Unlike an active breath-hold technique—where the patient is forced to hold his or her breath during treatment—the RPM system offers faster and more comfortable treatments by making it possible to deliver bursts of radiation that coincide with a patient’s natural breathing cycle. It is well suited for lung cancer patients who often have great difficulty in holding their breath, even for short periods. “Patients should just lie down and breathe normally,” says Waletzko. “Frankly, we want them to think about anything except breathing, so we don’t coach them.”

Ralf Rohn, MD, chief of the radiotherapy center at Klinikum, says, “There’s no doubt that lung cancer patients can benefit from respiratory gating, particularly if their tumor is toward the base of the lung. Although we’re in the early stages of treating lung patients with gating, the early signs are very positive.”

The 65-year-old retired electrical engineer from Dortmund, a lifelong nonsmoker, was selected for gated radiotherapy because of his overall condition and attitude. “He is very positive and in very good shape, which made him an ideal candidate for these treatments,” says Andreas Block, PhD, head of medical physics.

Varian is the only company to offer respiratory gating that follows a patient’s natural breathing pattern. The RPM system works by placing a marker box on the patient’s torso and monitoring respiration using cameras positioned in the treatment room. Extremely accurate gating is enabled by proprietary design features on the Clinac linear accelerator along with Varian’s high-speed digital control system, which can provide beam-on times of less than 100-ms bursts.

“There’s no doubt that this approach enables you to better protect normal tissue, increase patient comfort, and have fewer side effects.”

—Oliver Waletzko, MD, Klinikum Cancer Center, Dortmund, Germany

Varian is the only company to offer respiratory gating that follows a patient’s natural breathing pattern. The RPM system works by placing a marker box on the patient’s torso and monitoring respiration using cameras positioned in the treatment room. Extremely accurate gating is enabled by proprietary design features on the Clinac linear accelerator along with Varian’s high-speed digital control system, which can provide beam-on times of less than 100-ms bursts.

ABOVE | Oliver Waletzko, MD, Andreas Block, PhD, and Ralf Rohn, MD, of the Klinikum Cancer Center in Dortmund, Germany. Photo courtesy of the Klinikum Cancer Center.
## North American training opportunities

**High-Dose-Rate Brachytherapy for Prostate, Gynecological, and Breast Cancer course**  
Seattle Prostate Institute  
Seattle, Washington  
July 10–11, 2006  
October 16–17, 2006  
December 11–12, 2006  
**Visit**: [http://www.seattleprostateinst.com/coursedescriptions.htm](http://www.seattleprostateinst.com/coursedescriptions.htm)

**IGRT School for Radiation Therapists**  
MIMA Cancer Center  
Melbourne, Florida  
Ongoing; three-day sessions frequently scheduled  
**Call**: 321.409.1956

**IGRT Short Course**  
Stanford University Cancer Center  
Stanford, California  
November 10–12, 2006  
**Visit**: [http://www.stanford.edu/~lei](http://www.stanford.edu/~lei)

**IMRT School**  
UMass Memorial Medical Center  
Worcester, Massachusetts  
August 12–13, 2006  
October 21–22, 2006  
**Visit**: [http://www.knownexus.com/](http://www.knownexus.com/)

**Next Generation of Prostate Seed Implantation Techniques course**  
New York Prostate Institute  
Long Island, New York  
June 9–10, 2006  
September 29–30, 2006  
**Visit**: [http://www.nyprostate.org/](http://www.nyprostate.org/)

**Respiratory gating training**  
Stanford University  
Stanford, California  
June 9–10, 2006  

**Ultrasound-Guided Transperineal Brachytherapy for Early Stage Prostate Cancer course**  
Seattle Prostate Institute  
Seattle, Washington  
June 12–13, 2006  
August 7–8, 2006  
September 11–12, 2006  
November 13–14, 2006  
December 4–5, 2006  
**Visit**: [http://www.seattleprostateinst.com/coursedescriptions.htm](http://www.seattleprostateinst.com/coursedescriptions.htm)

**Varian product training programs**  
Varian Training Centers  
Milpitas, California, and Las Vegas, Nevada  
**Visit**: [http://www.varian.com/courses](http://www.varian.com/courses)

**Respiratory gating training**  
Stanford University  
Stanford, California  
June 9–10, 2006  

## European training opportunities

**Eclipse™ Applications course**  
Zug, Switzerland  
June 27–29, 2006  
September 5–7, 2006  
October 3–5, 2006  
November 7–9, 2006  
December 5–7, 2006

**Eclipse Management course**  
Zug, Switzerland  
June 20–23, 2006  
August 29–September 1, 2006  
September 26–29, 2006  
October 31–November 3, 2006  
November 28–December 1, 2006

**Gating School**  
Copenhagen, Denmark  
September 21–23, 2006

**IMRT Fast Track course**  
Berlin, Germany  
August 21–22, 2006

**IMRT School**  
Berlin, Germany  
October 24–27, 2006  
December 5–8, 2006  
Dijon, France  
November 21–24, 2006

**System Implementation course**  
Zug, Switzerland  
June 13–15, 2006  
August 22–24, 2006  
September 26–28, 2006  
October 17–19, 2006  
November 14–16, 2006  
December 5–7, 2006

**VARiS® Infomaker Reports course**  
Zug, Switzerland  
July 18–20, 2006  
September 19–21, 2006  
November 21–23, 2006

For a complete calendar of conferences and events, visit [http://www.varian.com/oncy/new117.htm](http://www.varian.com/oncy/new117.htm)
Introducing ARIA.

One voice. One solution.
Only the ARIA™ Oncology Information System provides your oncology team with the information they need to sing with one voice.

*The ARIA Oncology Information System is part of the Inspiration™ integrated oncology environment.*

*Inspiration, the Varian advantage*

Varian Medical Systems
3100 Hansen Way
Palo Alto, CA 94304-1038