

RT

image

award-winning magazine

the source for

Expecting **LIFE**

*The prevalence of
pregnant women
with cancer*

| PLUS |

- ☀ CAD Regulations
- ☀ Medical Misdiagnoses
- ☀ Implementing CAD

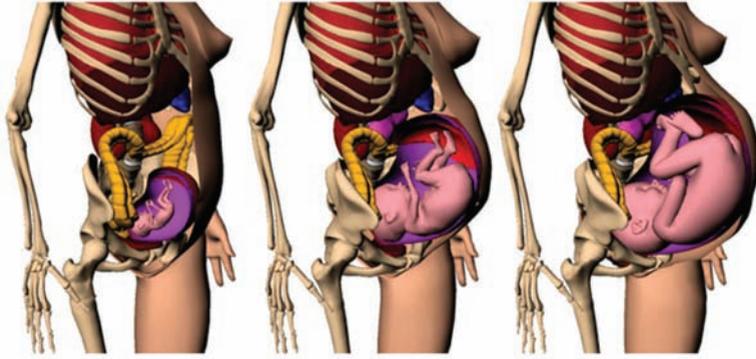


Expecting **LIFE**

*The prevalence of
pregnant women
with cancer*

By Keri Forsythe

WHEN PATTY MURRAY FIRST HEARD THE NEWS, SHE THOUGHT HER LIFE WAS OVER – LITERALLY. ALTHOUGH IT HAS BEEN MORE THAN 12 YEARS SINCE SHE RECEIVED THE BOMBSHELL, MURRAY CAN STILL REMEMBER THE PANIC THAT ENGULFED HER.



Researchers at Rensselaer Polytechnic Institute have developed new modeling tools that will enable more effective cancer treatment and imaging procedures for pregnant women. These finalized models, from left to right, represent a woman who is three months, six months, and nine months pregnant. The models were plotted with the design program, Rhinoceros.

"My first thought, of course, was 'I'm going to die,'" Murray says. "And that lasted for about a day or so – you're just going through all the stages of shock, horror; you just can't believe it is happening. You're young; you have a baby inside of you. It was just horrific."

Already the mother of two small children, Murray also felt unprepared – and terrified – at the new label that would define her: a pregnant cancer patient. Diagnosed with stage 2B/3 breast cancer during her third pregnancy, Murray became a poster child for cancer's ability to surface at the most unfortunate times. But, after the initial shock of the cancer diagnosis wore off, Murray then prepared herself for an even bigger challenge: fighting it.

Determined to tackle the cancer head on, Murray's doctor immediately ordered her to undergo treatment to destroy the aggressive, 5-cm breast tumor that was ravaging her body. However, since Murray was adamant on keeping her unborn son, Murray's oncologist only had one choice: to treat her as a non-pregnant patient.

Murray readily acknowledges the challenges that her condition presented to her doctor. "I think [he] had taken care of a person who was pregnant with cancer before, and he also did some research. [But] he told me that he had nothing to give to me; he had no journal articles and nothing to turn to," she says. "I just had to believe with blind faith that it would be okay for me to have major surgery and a lumpectomy, and start chemotherapy while I was pregnant."

Fortunately, Murray's treatment proved beneficial, and she gave birth to her healthy, 8-pound son, Patrick, less than four months after her diagnosis. Although Murray only gained 15 pounds during her entire pregnancy, she says that Patrick certainly didn't show any signs of fetal endangerment. After all, she jokes, "he was the only one of my three kids born with hair."

Murray attributes her successful outcome to her husband and children, referring to them as her "lifeline". She says, "Just knowing that I had children to take care of, or a baby inside of me, gave me all the more motivation to know that I had to be around for [them]."

Now chairman and cofounder of the Pregnant with Cancer network (www.pregnantwithcancer.org), Murray seeks to educate and inspire other expectant mothers battling cancer. Born out of a friendship she forged with two other survivors of cancer during their pregnancies, Murray's organization celebrated its 10th anniversary in September 2007. Providing subscribers with two newsletters per year – which feature a segment titled "My Story," where women can discuss their personal experiences – the Pregnant with Cancer network aspires to draw attention to an often overlooked demographic.

"I'm very happy that we're still around and very much continuing to grow," Murray says. "Our goal now is to reach even more women because the statistic is one in 1,000 [women] in the

United States alone is diagnosed with cancer while pregnant. [And according to a recent census] about births in America, about 4,000 women in American alone are diagnosed with some sort of cancer during their pregnancies."

For this female population, the fight against cancer is often an uphill battle. Fortunately, experts are developing new tools to ensure that pregnant women are receiving safer, more accurate radiation therapy and imaging procedures – without endangering the developing fetus. Thanks to such advanced means of treatment, cancer for these women may not necessarily be a situation of life or death.

PREGNANT PHANTOMS

Although pregnancy certainly presents obstacles for cancer patients, oncology experts are seeking new ways to enhance treatment for these women. Recently, X. George Xu, PhD, professor of nuclear and biomedical engineering at Rensselaer Polytechnic Institute in Troy, N.Y., garnered headlines for the set of therapy modeling tools he engineered for pregnant cancer patients. Enabling safer, more effective radiation therapy and nuclear medicine procedures, these tools have the potential to break ground in oncology treatment.

To determine the proper radiation dose for each cancer patient, oncologists utilize innovative computer simulations, which are based on virtual models of the human body, or "phantoms". Currently, approximately 30 phantom simulations are available worldwide. However, until now, no phantoms of the pregnant body existed.

"The human body is a particular challenge to model because of its wide variety of organs, each with a complex and unique shape," Xu says. "Pregnant females are even more difficult using current methods, so we took an entirely new approach."

Since developing fetuses are extremely sensitive to radiation, Xu says it's important that pregnant cancer patients are treated with the utmost care – and caution. For instance, ionizing radiation can predispose developing fetuses to a number of severe conditions, including growth impairment, mental retardation, malignancies, malformations, hereditary defects, and even death. Because of this, it's paramount that oncologists are as judicious as possible when administering radiation therapy to pregnant patients.

Xu says to properly gauge radiation dose to the fetus, oncology experts require a 3-D, anatomical model of the woman and her unborn child. Traditionally, these models are created from MR and CT images, as well as data obtained from cadavers. However, Xu says, "a challenge we faced was the fact that pregnant patients are (typically) prohibited from X-ray-based examinations because of radiation safety concerns, thus making the whole-body modeling difficult."



Telltale Cancer Warning Signs

- A change in bowel or bladder habits
- A sore that does not heal
- Unusual bleeding or discharge from any place
- A lump in the breast or other parts of the body
- Chronic indigestion or difficulty in swallowing
- Obvious changes in a wart or mole
- Persistent coughing or hoarseness

American Cancer Society

Fortunately, hope arrived – by accident. Several years ago, Xu and colleagues received a batch of CT images taken of a woman who was unaware of her pregnancy. Armed with these images, the researchers began developing models of the pregnant patient at different stages of gestation.

“The method we adopted was a ‘boundary representation’, or the ‘BREP’ method that the manufacturing and computer gaming industries [having been using] for years,” Xu explains. “The BREP method defines a 3-D object using polygonal meshes, instead of voxels that most medical images are based on.”

Xu says that he and his colleagues adopted this tactic to classify 3-D organs in the body. Most importantly, they learned how to alter the size and shape of the fetus in order to construct realistic portrayals of a pregnancy at different trimesters.

To Xu, the BREP tools represent a new era in cancer treatment for pregnant women. “These new models should be extremely useful for understanding the risks of radiation, and for better planning of radiation imaging and treatment for pregnant women,” Xu says. “The tools we have developed for this research should also open up several new avenues for improving the field of radiation dosimetry.”

In addition, Xu says cancer patients treated by radiation are at risk of developing secondary cancers if “measures are not taken to reduce leakage and scatter radiation from the linear accelerators that are used for treatment. In the case of pregnant patients, shielding is applied to reduce – but not eliminate – the exposure of the fetus.”

However, he says, thanks to BREP computation tools, physicians can better assess exposure and risk levels, thus enhancing therapy plans. These tools also enable pregnant patients to better understand their treatment so they’re fully cognizant of the potential risks involved.

RADIATION RED FLAGS

In addition to discovering better ways to treat pregnant cancer patients, healthcare experts are also studying the amount of radiation dose prescribed to expectant mothers with suspected diseases.

For instance, pregnant women took center stage at the annual meeting of the Radiological Society of North America last November. Examining the amount of radiation exposure expectant mothers received throughout the past decade, researchers from Brown University in Providence, R.I., reported staggering results: Pregnant women in the United States encounter an unprecedented amount of radiation.

“Through medical imaging examinations, we are exposing pregnant women to twice the amount of radiation as we did 10 years ago,” says Elizabeth Lazarus, MD, assistant professor of diagnostic imaging at the Warren Alpert School of Medicine at Brown University. “Overall, the levels of radiation to which we are exposing pregnant women are low, but they do carry a slight risk of harm to a developing fetus.”

To perform the investigation, the Brown researchers retrospectively studied certain imaging procedures – CT, nuclear medicine, and plain-film X-rays – performed at their institution over a 10-year period. Aspiring to discover how often these radiologic exams were conducted on pregnant women, the investigators also studied the resulting radiation dose to the fetus.

And the results were alarming.

One statistic the researchers reported is that the number of scans performed on pregnant women increased by 121 percent from 1997 to 2006. Surprisingly, the imaging modality with the greatest increase in utilization was CT. Some suspected medical conditions for which CT was increasingly prescribed included blood clots in the lungs, bleeding in the brain, and appendicitis.

Although Lazarus acknowledges that physicians are reluctant to recommend CT for pregnant women, she says that the number of expectant mothers who are advised for CT has markedly increased during the past decade. Studying 5,235 imaging procedures performed on 3,249 pregnant patients, the researchers found that the number of CT exams increased by approximately 25 percent per year.

Lazarus says that there are several possible explanations for this observed growth. Two reasons she cites are the development of new radiologic techniques to better diagnose ailments, and the motivation of hospitals and insurers to make rapid diagnoses to shorten hospital stays and improve patient care. Also, because CT is inexpensive and fast, it is often the imaging modality of choice.

This discovery comes at a time when a Nov. 29, 2007 review published in the *New England Journal of Medicine (NEJM)* raised many eyebrows concerning the overutilization of CT and its possible link to cancer. Indicating that only a few CT scans can expose patients to enough ionizing radiation to augment their cancer risk, the *NEJM* review has sent shockwaves throughout the imaging industry. (For more information regarding this study, see the *rt image* March 10 cover story, “The CT Controversy.”)

And the *NEJM* study begs the question: If ionizing radiation can increase a fully developed person’s risk of developing cancer, how could it affect an unborn child?

Still, Lazarus assuages pregnant woman that their likelihood of developing complications from CT exposure is low. “I want to assure patients that CT can be a safe, effective test for pregnant patients,” she says. “However, there are alternatives that should be at least explored. Pregnant patients should ask their doctors about other imaging or diagnostic tests that may not expose the fetus to radiation.”

| Keri Forsythe is associate editor of *rt image*. Questions and comments can be directed to kforsythe@rt-image.com.