News
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**Computer measures patients' breath to determine nutritional requirements.

DALLAS--We all know the importance of the air we breathe, but researchers can also study the air we expel and gauge nutritional treatment accordingly.

Using sophisticated computer equipment in the form of a portable metabolic cart, Carol Ireton, M.S., R.D., a research dietitian at The University of Texas Health Science Center at Dallas, can measure a patient's oxygen consumption and carbon dioxide output and determine the exact number of calories a patient needs in order to achieve maximum nutritional benefit.

The concept is not new. Since the 1930's, nutritionists and physicians have been using awkward machinery and complicated formulas to determine the number of calories a patient needs. But major fallacies existed with these methods. The room for human error was great, and the formulas were relatively inflexible. The formula used to determine the number of calories for a burn patient, for example, took into account only the patient's weight and percent of burns. Furthermore, there wasn't an accurate formula at all for other types of trauma or ill patients.

Ireton, who recently was chosen Recognized Young Dietitian of the Year by the Dallas Dietetic Association, uses the portable cart to visit patients at their bedside. The patient breathes in room air and breathes out into a mask. The computer then measures the volume of oxygen consumed and carbon dioxide produced in a given period of time. The machine can also be hooked directly to a ventilator or Ireton may use a tent or hood in cases of facial trauma. After a few minutes, the computer prints out data indicating the type of food energy used and the patient's average energy expenditure per 24 hours.

Why would a patient need a precise number of calories? Simply because "a burn patient is like a marathon runner," says Dr. Charles Baxter, Kidd Professor of Surgery, director of the NIH Burn Research Center and medical director of the Transplant Resources and Services Center. When a person is burned or suffers another trauma of any kind, the body responds by immediately speeding up all its healing functions. It's forced to work at excessive levels to both begin the healing process and to take over the functions of the injured parts. The heart beats faster as the body tries to replenish its blood supply, make more skin, fight off infection, replace lost fluid, and in burn cases, since the outer covering is severely damaged or gone, it must work harder to keep warm. All these efforts take alot of energy and place tremendous stress on the body.

When healing, the body will first use its available stored-up energy--proteins, fats and carbohydrates. Depending on the extent of burn or trauma, the patient may continue "full throttle" for three to four weeks.

To replenish this dwindling source of energy, the necessary caloric intake is determined and the patient is fed appropriate amounts of carbohydrate, fat and protein.

(over)

These patients, who are not eating regular meals but are fed through tubes (enteral) or intravenously (parenteral), receive glucose, fat and amino acids. Vitamins and minerals are added to the meal. And other supplements are added, as necessary, to treat specific problems.

"We found that in many cases we had been giving the patients alot more calories than they needed," says Ireton. Not only does this cause unnecessary weight gain, but it also forces the body to work harder. Energy is required to turn the extra calories into fat so that it can be stored. And researchers have found that this fat accumulates in the liver where it can lead to decreased liver function. In addition, when more energy is produced, more carbon dioxide and fluid are made making it harder for the patient to breathe or to be weaned from the ventilator.

Overestimation of requirements by patients on parenteral nutrition can also result in greatly increased cost. "The average bottle of parenteral nutrition costs about $110 and it was not uncommon to overestimate a patient's needs by a liter per day," said Dr. William Turner, assistant professor of Surgery and director of the Nutritional Support Teams at Parkland Memorial Hospital and the Veterans Administration Medical Center. "In addition, the extra volume causes fluid retention and a number of other serious physiological problems, he said. Excess calories cause metabolic stress requiring extra oxygen. Furthermore, increased amounts of carbon dioxide may be hard to eliminate from the body.

On the other hand, underestimation of nutritional requirements results in not providing what is necessary to carry out normal activity and an adequate response to disease.

"This provides a method by which we can determine the best way to meet patients' high, unique nutritional needs without underfeeding or overfeeding," says Ireton.

"Proper assessment is a critical factor in healing patients. We are seeing complications in burn patients' cardiovascular system and other detrimental effects caused by overestimating their caloric needs," said Ellen Heck, administrative director of the Skin Transplant Center for Burns and the Lions Sight and Tissue Foundation. "Over-assessment of caloric needs makes it much more difficult for patients to return to an active life," she said. "This complication is now being researched by Drs. (G.-Lena) Vega (research instructor, Biochemistry), (Drew) Gaffney (assistant professor, Internal Medicine) and Baxter."

"We have also used the computer to help us come up with a much more accurate formula to use when a metabolic cart is unavailable," said Ireton. Ireton and Turner have studied and charted 130 patients--30 burn patients, 30 non-burn trauma patients and 70 general surgery and medical patients--to form a more accurate individualized formula. The Parkland Formula is actually two formulas--one for each sex--that encompasses height, weight and age. The formula does not apply, however, to patients on ventilators, said Turner. "These patients require individualized measurements of caloric requirements using the metabolic cart."

By using the cart in other research areas, "We have also found that enteral feeding is often physiologically better for the patient than parenteral," said Turner. This is because the balanced nutritional regimen of most enteral feeding is more efficiently directed toward energy production than fat synthesis. And it costs much less. One liter of enteral formula costs about 60 cents while the same amount of parenteral costs $110.

Ireton usually tests a patient every two to three weeks unless he or she has

experienced any major change in condition or undergone surgery.

The machine actually has many more uses. "If we had more machines and more people to run them, the cart could be used for so many other research projects," said Ireton. It is an excellent tool for calculating normal calorie needs, for establishing a diet regimen for over- or underweight people, and it can measure stress tolerance in cardiovascular rehabilitation patients so that appropriate exercise routines can be outlined. The only problem with it, says Ireton, is that it cannot be used on very young children. Because of the reduced volume of air that children are able to expel, the machine cannot take an accurate reading.

The $50,000 machine was purchased with funds from the Golden Charity Guild, Inc., an organization of Dallas volunteers who raise money for burn research, patient care and education at UTHSCD and Parkland. Earlier this year they established a trust fund, now totaling $221,375, honoring Baxter and to be spent for research done by Baxter and his associates.

"Our end goal is to provide adequate nutritional support in as precise a way as possible," says Ireton. "By doing this, patients heal faster and more completely and feel much better when they go home."

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