THE TOP 10 MEDICAL INNOVATIONS OF 2009

by David Wheeler RRT, NPS

Recently, I had the opportunity to attend the unveiling of the Cleveland Clinic's third edition of the Top 10 Medical Innovations. The annual Medical Innovations Summit at the Cleveland Clinic is one of the more fascinating conferences in the world of medical design and innovation. This conference draws about 3,500 of the world's foremost leaders in intellectual property, finance and medical innovation. I found it quite interesting to listen to leaders from every facet of health care discuss topics ranging from the cognitive psychology of innovation and the creative process to intellectual property law, and then easily switch gears and outline the processes involved in the commercialization of an idea to the marketplace.

The Cleveland Clinic Top 10 list is the product of a rather rigorous selection process that seeks to recognize the procedures and products that may emerge with the greatest impact on medicine in the coming year. The selection process can be boiled down to a simple question: What new or innovative medical technology, device or therapy will emerge in 2009?

The inclusionary criteria for winning innovations were:

- It must have significant potential for short-term clinical impact
- It must have a high probability of success
- It must either be on the market or close to being introduced
- The innovation must be supported by data.

As I examined this list and heard the winning innovations announced, two real standouts seemed to be No. 10 and No. 4. I think that No. 10 will re-frame how we treat patients and how patients seek their treatment, and No. 4 will be with us for quite a while and will totally change diagnostic protocols as we now know them. Listed below are the Top Ten Medical Innovations for 2009.

10: Private Sector National Health Information Exchange

In case you were wondering, terabytes of your health care information are already stored on the servers of hospitals, insurance companies, schools and pharmacies throughout the country. A thorough scheme of e-based health records that links patients, medical practitioners, hospitals, pharmacies and insurance companies is already being established.

The creation of a computerized system that will become the fundamental medical file and digitized record of a patient's complete medical history will be actualized within this generation. Sooner than later, you will access and store your medical records in the same way that you access e-mail. This is a system-changing innovation that will improve both patient safety and outcomes and may enhance "travel" medicine.

9: Doppler-Guided Uterine Artery Occlusion

"One-third of the 600,000 hysterectomies performed each year in the United States are for uterine fibroids, non-cancerous abnormal growths of fat in the wall of the uterus that can grow to the size of a cantaloupe." Until now, a hysterectomy has been the most common treatment for uterine fibroids.

An innovative, noninvasive method, Doppler-guided uterine artery occlusion (DUAO) is currently in clinical trials at medical centers in North America and Europe. This procedure creates a hypoxic programmed death of the fibroids while maintaining all other anatomical structures. In the U.S. alone, this has the potential of sparing approximately 200,000 women a year the pain and heartache of undergoing a hysterectomy.

8: Integration of Diffusion Tensor Imaging (Tractography)

Diffusion tensor imaging (DTI) has the capacity to delineate the fiber pathways that connect the hundreds of billions of neurons in the brain. DTI is an innovative breakthrough technology that noninvasively explores the brain's white matter.

Utilizing DTI technology neuroscientists can establish the orientation of nerve fiber bundles, allowing for the accurate noninvasive mapping of the living brain. The "brain maps" are rendered as 2-D and 3-D color images. DTI is a leap forward in the technology for understanding and mapping the brain

7: LESS and NOTES Applications

LESS (LaparoEndoscopic Single-site Surgery) is laparoscopic surgery performed through a single incision in a patient's navel. LESS also may reduce complications that might occur after traditional open or laparoscopic abdominal surgery.

Recently this procedure was performed at the Cleveland Clinic in live-donor nephrectomies in live kidney donors for kidney transplantation. Live donor kidney harvesting is accomplished though a small incision in the navel. The living kidney donors recovered within two weeks with only an insignificant scar hidden by their belly button.

The NOTES (Natural Orifice Transluminal Endoscopic Surgery) process is unique and innovative in *continued on page 73*

David Wheeler will be a featured speaker at the 9th annual Focus Conference May 14-16, 2009 Disney's Coronado Springs Resort Orlando, Florida

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that the surgeon reaches an appendix, prostate, kidney or gallbladder via the body's natural cavities - the mouth, vagina or colon. The surgical procedure is effectively performed from the inside out with faster healing times, less pain and fewer potential complications.

LESS and NOTES both enhance the performance of surgeries with a bare minimum of wounding and, effectively, no scarring. The patient's pain levels are significantly reduced and the recovery period is shortened.

6: New Strategies for Creating Vaccines for Avian Flu

Epidemiologists know it is very likely that the world is going to experience a lethal flu pandemic. Avian influenza is adept at mutating and spreading in an effective manner, making avian flu pandemics bona fide concerns and almost expected realities. Avian flu is set in motion by a mutating virus that can pass from birds to humans, and it remains a continued threat. Experts estimate that the virus could brutally attack nearly a half million Americans and kill as many as 200,000. A contemporary vaccine that uses an imitation version of the bird virus called a virus-like particle (VLP) may be a superior response in protecting against infection from the avian virus. VLPs for avian flu are created with a structure similar to a virus, only they are benign. VLPs bind to cells thereby triggering a native immune response sufficient to protect one exposed to the virus.

Recently, an experimental VLP vaccine produced an immune response in opposition to H5N1. VLPs are easier to develop, produce and manufacture, and they are eminently adaptable. This innovative technology could literally save the world one day.

5: Percutaneous Mitral Valve Regurgitation Repair

Mitral valve regurgitation (MVR) is present in cases where the mitral valve fails to seal completely. This all too common valvular disorder may arise from abnormalities in any part of the mitral valve. The patient typically presents with exertional dyspnea and fatigue due to the combination of a decreased cardiac output and an increase in left atrial pressure secondary to the backflow across the mitral valve. Some patients may present with intermittent or persistent atrial fibrillation.

Percutaneous mitral valve regurgitation repair, an innovative and experimental nonsurgical MVR procedure, involves a special clip that is a tiny barbed wishbone-shaped device. A cardiac catheter is carefully guided through the femoral vein to the heart's mitral valve. The clip, riding the tip of a catheter, is clamped on the central valve leaflets, which holds them together and re-establishes normal blood flow. This clip is now in the eighth year of human testing and will be available very soon. In this fashion, the mitral valve is repaired, nonsurgically from the inside out.

4: Multi-Spectral Imaging Systems

The current standard of care is for pathologists to use an immunohistochemical staining technique for protein distributions. This form of assessment allows pathologists to examine tumor sections with a microscope and color camera. Currently, these cameras detect only three visible wavelengths and, utilizing this technology, pathologists must look at one microscope slide for each single protein. Multispectral imaging technology systems permit researchers to spectrally assess up to six chromogens (colors) in a single tissue section and look at tissue samples with 10 to 30 different wavelengths. This generates more diagnostically significant information and facilitates the understanding of intricate and complex signaling pathways in cancer cells.This quantum leap in imaging examination, assessment and knowledge will aid in the development of specifically targeted therapies for individual patients. Multispectral imaging is truly revolutionary.

3: Diaphragm Pacing System

Diaphragmatic pacing is accomplished with a series of electrodes connected to the phrenic nerves on the diaphragm. Wires from the electrodes run to and from a control box that is approximately the size of two decks of playing cards. When the electrodes are activated, the current causes the diaphragm to contract rapidly, expanding the thoracic area and gas flows into the lungs following the resulting naturally occurring pressure gradient. The electrodes then de-activate, causing the diaphragm to relax, and the patient exhales passively due to the elastic recoil of the lung parenchyma.

The diaphragmatic pacing device is an extraordinary leap forward and has tremendous potential for patients unable to maintain adequate minute ventilation due to diaphragmatic malfunction. This innovative technology will free thousands from the disastrous effects of prolonged respiratory pump failure and mechanical ventilation.

2: Warm Organ Perfusion Device

Many people find it rather shocking that for the past 30 years, human organs on their way to new homes have been transported in coolers that are very similar to the ones that can be found at any tailgating party. This has been a major concern for transplant specialists who have attempted several solutions without success. There may be a superior system for the transport of a variety of living organs. This new device is a smaller, portable rendition of a cardiac perfu- *continued on page 77*

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sion device. Upon harvesting the organ, donor blood is circulated through the heart-lung pump to the warm, living organ. The donor blood is heated and oxygenated, and the organ is transplanted in a pre-oxygenated state. This warm organ perfusion device will greatly expand the currently limited transplant window. This breakthrough innovation will have a significant impact on all organ transplants.

1: Use of Circulating Tumor Cell Technology

A new technology will enable oncologists to measure circulating tumor cells (CTCs) in a sample of blood. CTCs are cancer cells that have broken away from an existing tumor cell and are found in circulating blood samples. The detection of CTCs is a significant finding and may help predict a patient's prognosis.

This technological advance will facilitate the early detection of rogue cancer cells in patients who have experienced recurrent cancer. This will give patients the ability to assess their progress with treatment and focus the patient-physician team on future therapeutic options. This breakout technology will have critically important reproductions in the lives of many cancer patients' worldwide and will help in guiding future therapeutics.

The informed clinician will, of course, understand that this has been but a perfunctory review of these exciting technologies. I think it is an essential component of compassionate, evidence-based care that clinicians maintain a contemporary knowledge of evolutionary therapeutic options. To that end, I would encourage further investigation of these innovations.

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to take one outside in nice weather and do a PASS (Pull, Aim, Squeeze, Sweep)? Some may only last for 10 seconds of use and can get very cold to the touch when handling.

More things to consider:

- At what point would you close the main oxygen shut-off valve for the hyperbaric area – as you run past it?
- If a horizontal evacuation can no longer be used, where are the stairwells located?
- If the fire has blocked your exit, is there a second exit door? If both were blocked would you seal the doors with wet blankets while notifying security of your trapped situation?
- Sometimes windows can be used for escape but this decision is made only after better options are eliminated.

In discussing these scenarios with staff, we found ourselves unsure of some of the answers, which raised our anxiety levels. Not knowing the answers ahead of time can lead to wasted time and panic - a deadly mix. If practice in a controlled situation can raise tension, imagine the anxiety and staff performance in the real situation.

Knowing the answers and practicing the procedures is the only way to give your patient and yourself the best chance of getting it all right when your survival depends on it. Why not practice a fire evacuation in the hyperbaric department as part of the hospital-wide fire drill program for 2009?

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rescue long-acting bronchodilator that relaxes the muscles in the airways to improve breathing. Budesonide is a steroid that reduces inflammation in the airways. Symbicort is also used to treat bronchospasm in people with COPD, chronic bronchitis and asthma ("Drugs, 2008"). The difference between these two drugs is that formoterol has an onset of 15 minutes and a peak time of 30-60 minutes when compared to Salmeterol's onset of 20 minutes and peak time of 3-5 hours (Gardenhire, 2008).

Advair's dosing should be administered orally inhaled only and given twice daily. If this drug is to be given in a sequence, Advair is to be given last. First, the fast acting rescue bronchodilator is given (SABD), along with mucomyst if needed. The very last drug given would be Advair, making sure the patient rinses and spits afterwards. Advair Diskus is a powder form of fluticasone and salmeterol that comes in a special inhaler device preloaded with blister packs that contain measured doses of medicine. Advair also comes in an HFA inhaler; this is considered the more "green" approach, and is better for the environment when compared to a metered dose inhaler. After the drug is inhaled, rinsing the mouth without swallowing is ideal to prevent the growth of yeast in the mouth. There are three combinations of dosages available, the smallest dosage is 100mcg/50mcg, the intermediate dosage is 250 mcg/50mcg, and the highest dosage is 500mcg/50mcg. Another important factor to consider when taking a dry powder inhaler is that the patient must be able to generate air flow at least 60 liters per minute to adequately take the medication (Gardenhire, 2008).

Many concerns have been raised that salmeterol may increase the risk of an asthma-related death. Research has shown that the African-American ethnicity has a higher risk than Caucasian ("PDR", 2007).

In conclusion, I researched in the Asthma and COPD guidelines in Appendix D and found that Advair is to be given at step 2, mild persistent asthma the preferred treatment is a low-dose inhaled corticosteroid. From all of this research and case studies, I found that Advair is safe for use, even though there were deaths related to the use of this drug. It's too bad that this drug was not available 15 years ago, when my younger sisters suffered from asthma. I feel they could've benefited from it to increase their quality of life.

"Sorry the product didn't work. We'll send you another one that doesn't work."